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15, 1940
3 29, No. 8

AMERICAN
DYESTUFF
REPORTER

Experience declares a dividend

Not too long ago a celebrated newspaper man was invited to visit a well-known full-fashioned hosiery mill. He returned home and wrote a story expressing his amazement at his experience and at the art displayed in dyeing.

Like any other art, hosiery dyeing requires years of experience if the mill hopes to declare dividends. Needless to say the dyer must know his "tools"—what the dyestuffs will do when he starts his formulae, and what to expect of them when additions are necessary, to be assured of a minimum of "seconds."

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Seven Mules of Hosiery

They know they can rely on the uniformity of these seven colors and they know the ultimate consumer has been pleased with the finished hosiery.

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In this old-fashioned mechanical savings bank, a coin is first placed in the large monkey's hand. The lever at the base of the tree is then pressed, causing the little monkey to jump on the big one's shoulders and at the same time to give his arm a push. This dislodges the coin, which drops toward the lion who opens his mouth just in time to receive it. The coin goes through the lion into the base of the tree, which is the bank. This is another of the old-time, 19th Century banks that are today collectors' items.

THERE ARE MANY NOVEL WAYS TO SAVE WITH DECERESOL*, TOO!

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The preparation of grey cotton piece goods to be printed direct from the bale.

An admixture to vat color pastes where the process calls for pigment dyeing with subsequent reduction in the fibre or fabric.

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Knitting Arts Exhibition Number

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APRIL 15, 1940

VOLUME 29 NUMBER 8

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AMERICAN CYANAMID COMPANY

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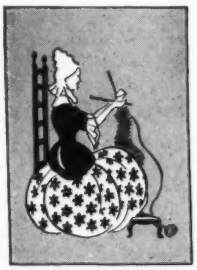
Knitting Arts Exhibition Number

AMERICAN

DYESTUFF REPORTER

VOLUME 29 APRIL 15, 1940 NUMBER 8

Thirty-Sixth Annual



Knitting Arts Exhibition

COMMERCIAL MUSEUM • PHILADELPHIA

• APRIL 15, 16, 17, 18, 1940 •

THE thirty-sixth annual knitting arts exhibition opens today at the Commercial Museum in Philadelphia, Pa., and will continue through Thursday of this week. It is held under the joint auspices of the National Association of Hosiery Manufacturers and the Underwear Institute.

Many of the exhibits are planned to appeal primarily to those engaged in the wet processing of knit goods. For your convenience we present the following list of such exhibitors with a brief description of the displays. We suggest that you see the entire show if you have time but if you are in a hurry we believe that this list represents those exhibits in which you will have the greatest interest.

Exhibits of Special Interest to the Wet Processing Branch *of the Knit Goods Industry*

ALUMINUM COMPANY OF AMERICA
AMERICAN MAGNESIUM CORPORATION
Pittsburgh, Pa.
Spaces 446-447

This is a cooperative display between the two companies listed above. They show the various applications of aluminum and magnesium to the textile industry in general and have a number of representatives from both companies on hand for the duration of the exhibition.

AMALGAMATED CHEMICAL CORPORATION
Auburn St. and Trenton Ave., Philadelphia, Pa.
Spaces 23-24

Exhibited here are textile oils, softeners, soaps, textile finishes, etc.

In attendance—HAROLD B. DOHNER, ROBERT A. BRUCE, FRANCIS T. QUINLAN, JOHN T. MCGROGAN, JOHN M. JESTER, JR.

THE BRISTOL COMPANY
Waterbury, Conn.
Space 363

Instruments for the automatic control of temperature and humidity in the dyeing and finishing departments of a textile mill are shown here. Featured is a time-temperature air-operated recorder controller mounted on a standard steel panel and operating a series of signal lights and an air-operated valve, to demonstrate how these instruments automatically control such operations as dyeing.

In attendance—F. W. BORCHERS, Philadelphia district manager; D. C. SANFORD, S. E. GEWIN, sales representatives; C. WEBBER, New York district manager; F. A. FAUST, development engineer; J. H. FERGUSON, sales engineer; C. A. MABEY, development engineer.

H. W. BUTTERWORTH & SONS COMPANY

York and Cedar Sts., Philadelphia, Pa.

Spaces 64-65-66

On display at this exhibit are the following items:—a completely automatic 256-package stainless steel package yarn dyeing machine, incorporating new features of design and principle which are said to have already proven very advantageous in package yarn dyeing; a laboratory model 1-package capacity of this machine; a motor driven package rounding machine for breaking the shoulders of hard packages preparatory to dyeing; a micro set laboratory model padder; a Tube-Tex double processing machine for tubular fabric which is built by Butterworth under license from the Tubular Textile Machinery Corp. and which is said to have many advantages over any other type and to enable the production of new finishes not otherwise obtainable. The above machines will be in partial operation.

In attendance—HARRY W. BUTTERWORTH, JR., president; DEHAVEN BUTTERWORTH, vice-president; J. EBERT BUTTERWORTH, treasurer; JOHN H. S. SPENCER, sales manager; WILLIAM F. HENNESSY, manager, rayon division; WILLIAM E. H. BELL, manager, dyeing machine division; For Tubular Textile Machinery Corp., MORTIMER COHN, EUGENE COHN, JULES WALTER, JOSEPH GUIMOND.

W. F. FANCOURT & CO.

516 South Delaware Ave., Philadelphia, Pa.

Space 249

Featured here are finishes for nylon hosiery which were developed after considerable research work and cooperation with leading knitters of this fiber and which are said to impart an excellent finish with no change in shade and to be simple in application. "Nylon Scour" for removing the sizes of the yarn is also shown. "Fanco" Resinol, a thermoplastic resin emulsion which is said to have the properties of binding the interstices of the silk and to form a pliable plastic film and which can be used in conjunction with their delustering and other finishing materials and which, at the usual drying temperature, produces a semi-permanent finish and greatly reduces the tendency to snag and run is also shown. Other new products are shown as well as their standard "Fanco" Aquapel, delustering and ingrain finish. Hosiery finished with these various products are on display.

In attendance—W. F. FANCOURT, JR., W. F. FANCOURT, 3RD, CHARLES T. HARVEY, HOWARD A. VIRKLER, CLAUDE G. WOLFF.

FLETCHER WORKS, INC.

Glenwood Ave. and Second Sts., Philadelphia, Pa.

Spaces 172-173

Of particular interest to wet processors at this booth is the streamlined Fletcher "Standard" extractor. Also exhibited are the company's latest developments in the throwing machinery line.

In attendance—O. W. SCHAUM, R. J. BARTHOLOMEW, C. W. MOORE, F. SCHAUM, W. H. ROMETSCH, JR., F. W. WARRINGTON, H. N. RAHN, W. W. EGEE.

THE J. B. FORD SALES CO.

Wyandotte, Michigan

Space 352

Wyandotte specialized alkalies for the textile mill are on display.

In attendance—H. M. FLACK, H. E. MOYER, W. B. DAVISON.

GRAND RAPIDS TEXTILE MACHINERY CO.

Grand Rapids, Mich.

Spaces 159-160-185-186

Featured at this exhibit is a new completely enclosed stainless steel scouring and dyeing machine made for handling vat, naphthol, developed and other wash fast dyestuffs. A new improved inspection machine for tubular knit or flat goods and the Universal calender and folder for steaming, spreading, calendering and folding tubular knit fabric of cotton or worsted are also shown.

In attendance—W. H. SHIELDS, W. F. MOON, M. F. SHIELDS.

E. F. HOUGHTON & CO.

Third, American and Somerset Sts., Philadelphia, Pa.

Spaces 427-428

This exhibit features the following products: FF Silk Oil for silk soaking; Scourol for degumming; Surfax W.O., a dye bath assistant; N-25 and Surfax, detergents; Raylubric, a rayon oil; Hosiery Wonder Powder, a soap for scouring, washing and fulling; Sta-put Lubricants for knitting machines; knitting machine oils to prevent needle rust.

In attendance—C. B. KINNEY, manager, textile sales; H. E. SANSON, Eastern divisional sales manager; W. H. BRINKLEY, southern divisional sales manager; D. C. MINER, advertising manager; H. H. KIRKPATRICK, H. C. ROBERTS, C. E. KITE, O. H. MCCLAY, sales representatives.

HYGRADE SYLVANIA CORPORATION

Salem, Massachusetts

Space 178

A number of different types and sizes of Hygrade Miralumes (complete fluorescent lighting units) are featured here. There are also exhibits of Hygrade incandescent and fluorescent lamps.

In attendance—HOPKIN BROS., INC., of Philadelphia with B. C. WHITE, JR., in charge.

INDUSTRIAL DRYER CORPORATION

Stamford, Conn.

Spaces 14-15

Exhibited here is the latest type of their patented H-W conditioner and twist setter.

In attendance—C. M. KITZMILLER, H. B. FOULDER, F. W. CAESER, G. D. MILLSPAUGH, I. E. NORVIG, J. R. TUTT.

INTERNATIONAL NICKEL CO., INC.
67 Wall Street, New York, N. Y.
Spaces 16-17

This exhibit features Monel mill and fabricated forms for use in the dyehouse and other textile wet processing applications. Special attention is given to the use of Monel as standard material for the construction of hosiery dyeing equipment.

In attendance—E. A. TURNER, C. J. BIANOWICZ.

LAUREL SOAP MFG. CO., INC.
2600 E. Tioga St., Philadelphia, Pa.
Spaces 210-211

Hosiery, underwear, yarn and piece goods finished with Laurel finishes are shown at this booth.

In attendance—C. E. BERTOLET, WM. H. BERTOLET, JR., A. HENRY GAEDE, W. R. SARGENT, C. C. HAGELGANS, E. W. SEASONGOOD.

LEATEX CHEMICAL CO.
2722 North Hancock Street, Philadelphia, Pa.
Space 42

This booth is maintained as headquarters for salesmen and guests.

In attendance — JOHN M. MCCHESNEY, JOHN F. RIEDER, LOUIS A. GREGG, MAURICE M. GUERTIN, CHAS. L. HAMMELL, HERBERT HIGGINBOTHAM, CLAUDE I. RUTH, JR., LOUIS SOISTMANN, ROBERT R. WILLGOOS.

THE MILLER COMPANY
Meriden, Conn.
Space 166

Fluorescent lighting fixtures are displayed here.

In attendance—L. M. GRAWEMEYER.

NAPTHOLE, INC.
416 Division Street, Boonton, N. J.
Space 56

Shown here are the following products: a complete line of detergents, dyeing and finishing agents featuring Naptex, a detergent, Quix, a dye assistant, and Luxolene, a finishing compound. A complete exhibit of various print goods, viscose and cellulose acetate rayon piece goods which have been scoured, dyed and finished with their products is also shown. In addition a special type hosiery oil called Luxolene Hosiery Oil No. 140 is exhibited with samples of hosiery treated with same.

In attendance—HARRY A. CARMAN of the New York division, in charge; JOSEPH BROHEL, JR., textile specialist; A. L. WATSON, New England manager; W. A. CUMMINGS, New England division; FRANK W. JOHNSON, Southern division; K. W. HARTMANN, Boonton factory.

NATIONAL CARBON COMPANY, INC.
CARBON SALES DIVISION
Cleveland, Ohio
Space 57

This company is demonstrating the National Type XH accelerated fading unit which incorporates the use of the new three-phase carbon arc said to closely approach natural sunlight in color quality and effect. Samples of dyed fabric exposed in this unit are on display. In addition there is also a display of carbon, graphite and "Karbate" pipe, fittings and valves designed for conducting corrosive gases and liquids. Examples of the application of these products to the construction of heat exchangers and heat transfer apparatus is also shown.

In attendance—C. G. OLLINGER, F. HOHMEISTER, J. S. COPLEY.

ONYX OIL & CHEMICAL CO.
Jersey City, N. J.
Space 218

There is shown a general display of the company's products for use in the hosiery, underwear and knit goods field. Featured is the Xynomine group of compounds which the company has recently placed on the market for the processing of all types of fibers and mixtures. In addition there is an advance showing of the new nylon snag proof finishing compounds, Dullaperm, Aquaperm and Fibraperm.

In attendance—A. C. MACKEY, manager, hosiery service division; DR. H. H. MOSHER, director of research; A. R. JENNY, Canadian sales manager; CHARLES E. MAHER, mid-west representative; E. W. KLUMPH, CLIFF MYERS, southern representatives; J. W. HUBER, R. A. WATSON, Pennsylvania representatives; JOHN TRESIZE, New England representative; WILLIAM TRESIZE, New York representative; CHARLES D. EHRENGART, general sales manager; LEON P. BRICK, assistant general sales manager.

PHILADELPHIA METAL DRYING FORM CO.
Hunting Park Avenue at 16th St., Philadelphia, Pa.
Space 105-AA

Exhibited here is the following equipment: improved rotary hosiery boarding machines, interchangeable hosiery drying forms, machines for inserting hosiery in envelopes, machines for inserting tissue in hosiery, hosiery finishing equipment.

In attendance—PAUL GUGGENHEIM, JOSEPH SELIGMAN, RICHARD GUGGENHEIM, JOHN E. FOX.

PROCTOR & SCHWARTZ, INC.
Seventh Street and Tabor Road, Philadelphia, Pa.
Spaces 268-269-277-278-291-292

Two new machines are shown here: the modern Proctor automatic boarding, drying, stripping, piling and counting machine for hosiery and the Proctor single-operator preboarding machine for nylon hosiery. It is claimed that the output on the automatic boarding machine can be as high as the manufacturer desires, limited only by the mechanical speed, 32 dozen pairs of women's hosiery per hour and 52 dozen pairs of men's half hose per hour. It is stated that the new pre-boarding machine for nylon hosiery gives uniform and high quality results combined with an output high enough to keep steam and power costs at lowest levels.

QUAKER CHEMICAL PRODUCTS CORP.
Conshohocken, Pa.
Space 419

Products for use in various textile processes are exhibited.

In attendance—E. NIESSEN, vice-president, in charge; L. O. BENOLIEL, vice-president; GEORGE F. ECKER, JOHN W. BROWN, HARRY N. KOPPLE, ROBERT ZAMETKIN, DANIEL FINKEL, ALBIN JOHNSON, HENRY H. GILMANN.

REPUBLIC STEEL CORPORATION
Cleveland, Ohio
Spaces 46-47-48-49

This exhibit is patterned along the same lines as previous years. Major emphasis is placed on new and old applications of stainless steel in this industry. Fabricated products of customers are shown.

In attendance—C. C. SNYDER, GEORGE W. HINKLE, E. S. DEHN, H. N. EVANS, W. S. PATTERSON, W. E. STUEBING, J. K. BOLE, JR.

SCHOLLER BROTHERS, INC.
Collins and Westmoreland Sts., Philadelphia, Pa.
SCHOLLER BROTHERS, LTD.
St. Catherines, Ontario, Canada
Spaces 252-253

Shown here is a complete line of soaps, softeners, sulfonated oils, specialties and finishes, especially those used in the knit goods trade. Samples of fabrics treated with the various products are also shown. Of particular interest are the new synthetic resin types of finishes which are said to yield permanent delustering, repellency, improved hand and feel.

In attendance—L. M. BOYD, W. A. DANIEL, WM. JACKSON, JR., H. A. MILLER, E. S. ATKINSON, J. F. NOBLE.

SMITH, DRUM & COMPANY
Allegheny Ave. Below 5th Street, Philadelphia, Pa.
Spaces 27-28-29-30-31-32-33-34-35

Hosiery, skein and package dyeing equipment is shown in operation.

In attendance—HARRY S. DRUM, WILLIAM C. DODSON, JAMES E. MACDOUGALL, JOE M. BALLENTINE, PERRY M. PARROTT.

ALFRED SUTER
200 Fifth Avenue, New York, N. Y.
Space 429

Of particular interest to the dyers of yarn in package form is the Suter Manville Package Density Tester, for determining the tightness of wind of packages destined for package dyeing, the aim being to be able to establish standards of hardness of packages for perfectly even dye penetration and to be able to control this hardness in the winding of packages. This machine can also be used to determine the density of yarn on cones, especially rayon cones. Other machines on display include: Taber hosiery abraser, Kayser lubricity tester, skeinette machine, Suter motor driven twist tester, Universal yarn numbering balance.

UNITED STATES TESTING CO., INC.
1415 Park Avenue, Hoboken, N. J.
Spaces 420-422

Special testing equipment is featured at this exhibit.

In attendance—A. L. BRASSELL, S. B. WALKER, A. J. KELLNER, W. F. MORGAN, H. M. BLOCK.

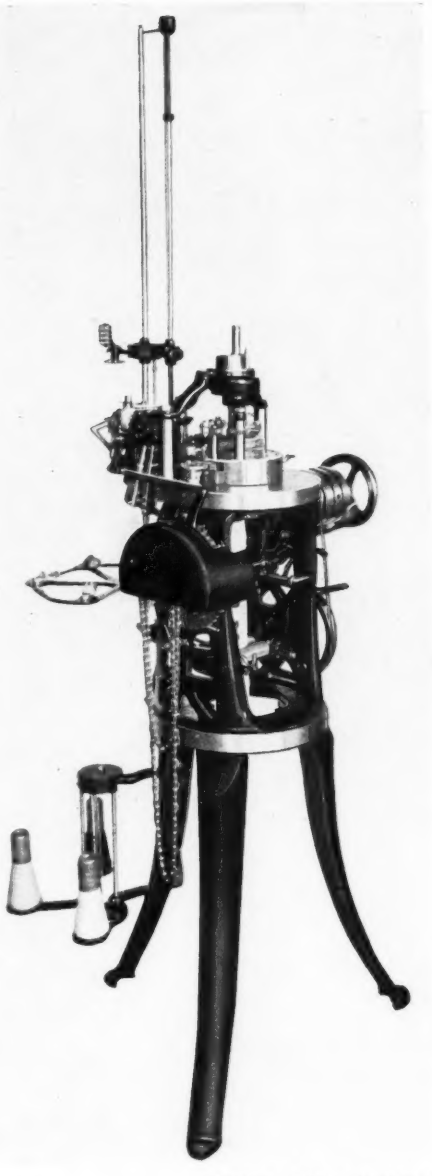
Processing Yarn for
Ingrain Knitting

THOMAS R. SMITH*

THE quality of fabric produced by ingrain knitting of bleached and dyed cotton yarns depends not only upon the knitting machine but also in a large way upon the spinning, processing and finish of the yarn itself. It is taken for granted of course that the knitting machine must be of the correct design and modern in every way or the results both from a standpoint of quality in the fabric and efficient operation will be disappointing. Great improvements have been made in recent years by the different knitting machinery companies on various types of machines especially adapted to ingrain knitting. There are machines for multi-color design, machines which knit as many as 32 ends at once. All of these very modern and efficient machines can be seen at the Knitting Arts Exhibition in Philadelphia this year and in years to come.

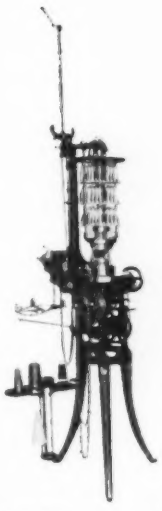
To maintain quality to the highest possible degree is of great importance since the ingrain kntited fabric is more expensive to produce than piece dyed or bleached knit goods and therefore must have greater sales appeal to justify its increased cost. The factors that make up this

*Supt. Yarn Dyeing Dept., Wiscasset Mills Co., Albemarle, N. C.



Courtesy, Fidelity Machine Co.

Style S-12-P Machine used for cuffs of infants', children's and misses' hosiery in applying the stripes by means of yarn selection and knot tying.



Multi-Design Machine which knits up to 120 colors vertically and 5 colors horizontally.

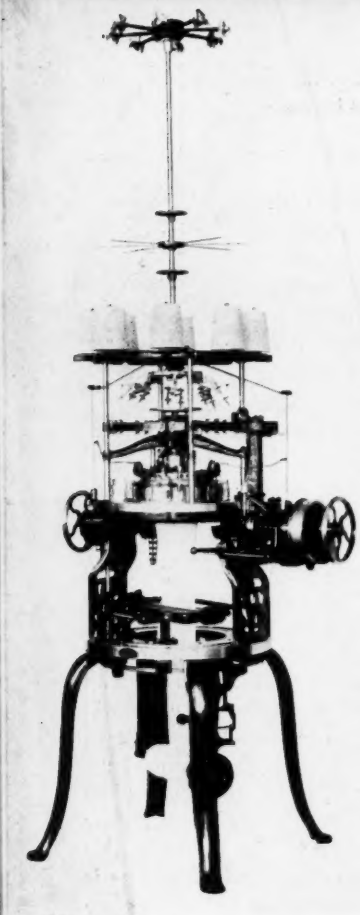
Courtesy, Fidelity Machine Co.

superiority are stitch, elasticity, feel or handle, brilliance of color and fastness of color.

If any fabric is to hold its popularity and not pass on as a fad it must not be cheapened to the extent that many fabrics have been in the past. A perfect example of how it is possible to reduce quality is shown in the tuck stitch underwear fabric from which ladies' snuggies and other underthings are made. When first introduced about 10 years ago the construction consisted of 2-ply combed peeler mercerized dyed cotton in combination with rayon, wool or silk,—a very high class fabric of excellent feel or handle. The first step to cheapen was the substitution of 2-ply combed unmercerized for mercerized, next single combed instead and now single carded with only half the number of cotton ends dyed, using darker shades and blending with an equal number of carded cotton ends in natural to produce a bleached shade and a fabric which has now reached the bottom of the ladder as far as quality is concerned. Of course this fabric can now be sold at a price that will be within the reach of a great many additional consumers but it has become so competitive that little or no profit is left for the manufacturer.

When the cheapening process is applied to fancy ingrain hosiery or knitted outerwear the results are more disastrous than in underwear. Here the appearance is more noticeable and the low grade yarns with their dull colors stand out glaringly. After several experiences with fugitive dyes and harsh finished goods the consumer will shun such merchandise in the future and the cycle of preference for other fabrics is speeded up on around the circle. The knitted outerwear industry will suffer more from this change of preference than hosiery or underwear since woven fabrics will probably be the gainer in this instance. The change so far as hosiery and underwear is concerned will most likely be from ingrain knitted to piece dyed or bleached knit goods.

In order to produce cotton yarn, for example, that meets the necessary requirements, the first consideration of course is the cotton,—its staple, character and shade. Off shade cotton improperly blended will cause variation in both bleached and dyed yarns which will eventually appear in the knitted fabric. Next in importance is the evenness of the yarn, freedom from slubs and with a minimum number of knots. Combed cotton yarn is always preferable for ingrain knitting since carded yarn is of lower grade and thereby cheapens the fabric. The type of color whether direct, sulfur, developed, vat or naphthol depends upon the type of fabric and also depth of shade. In the case of hosiery where only fastness to washing is required, selected direct dyes for light colors are satisfactory, with developed, vat and naphthol colors for the darker shades. Sulfur colors are not satisfactory for ingrain knitting yarns due to their insolubility resulting in unevenness and harshness. For underwear, mostly bleach base colors are used; therefore high grade fast to light directs are satisfactory since they are very fast to washing in light shades. Pajamas for both ladies and men require, besides direct colors for light shades, faster dyes for the heavier colors and it would be well to consider the use of vat and naphthol dyestuffs in this field. Developed dyes are used but their fastness qualities are limited and a very high grade line of pajamas dyed with vat and naphthol colors could be merchandized in a first class manner.



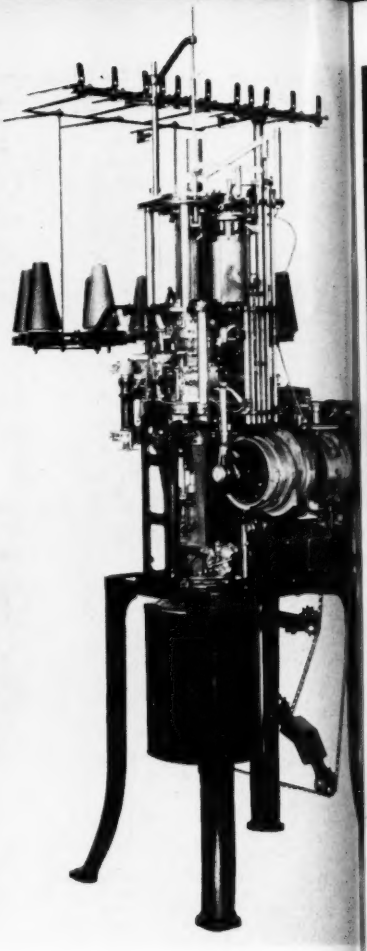
Men's undershirts of the highest grade are knit from bleached cotton yarns either mercerized or unmercerized combed. The advantages of this fabric are very apparent on the store counter and the choice of nothing but the finest in yarns an absolute necessity.

Vat and naphthol colors are forging ahead rapidly as dyestuffs for cotton in the knitted outerwear field. Permanence of color, both to light and water, have greater value to the consumer here than anywhere. Sweaters for men, women and children, complete suits for boys, dresses, bathing suits, caps and various other garments all have much greater sales appeal and can hold their popularity if the fastest colors obtainable are used. Intelligent styling and the use of new colors, etc., are ways in which an increasing consumer demand will be brought about.

A very close relationship should exist between the dyed yarn manufacturer of knitting yarns and the knitter and in this way the ultimate in fabrics will be attained. After all it is one business and the finished product is spoiled if either the yarn or the knitting operation is not correct.

LEFT — Automatic Double Butt Tuck Dogless Revolving Cylinder Machine.

Courtesy, Scott & Williams, Inc.



RIGHT — S & W Komet Links and Links Machine.

Courtesy, Scott & Williams, Inc.

A Consideration of the Practical Aspects of the Dyeing and Processing of

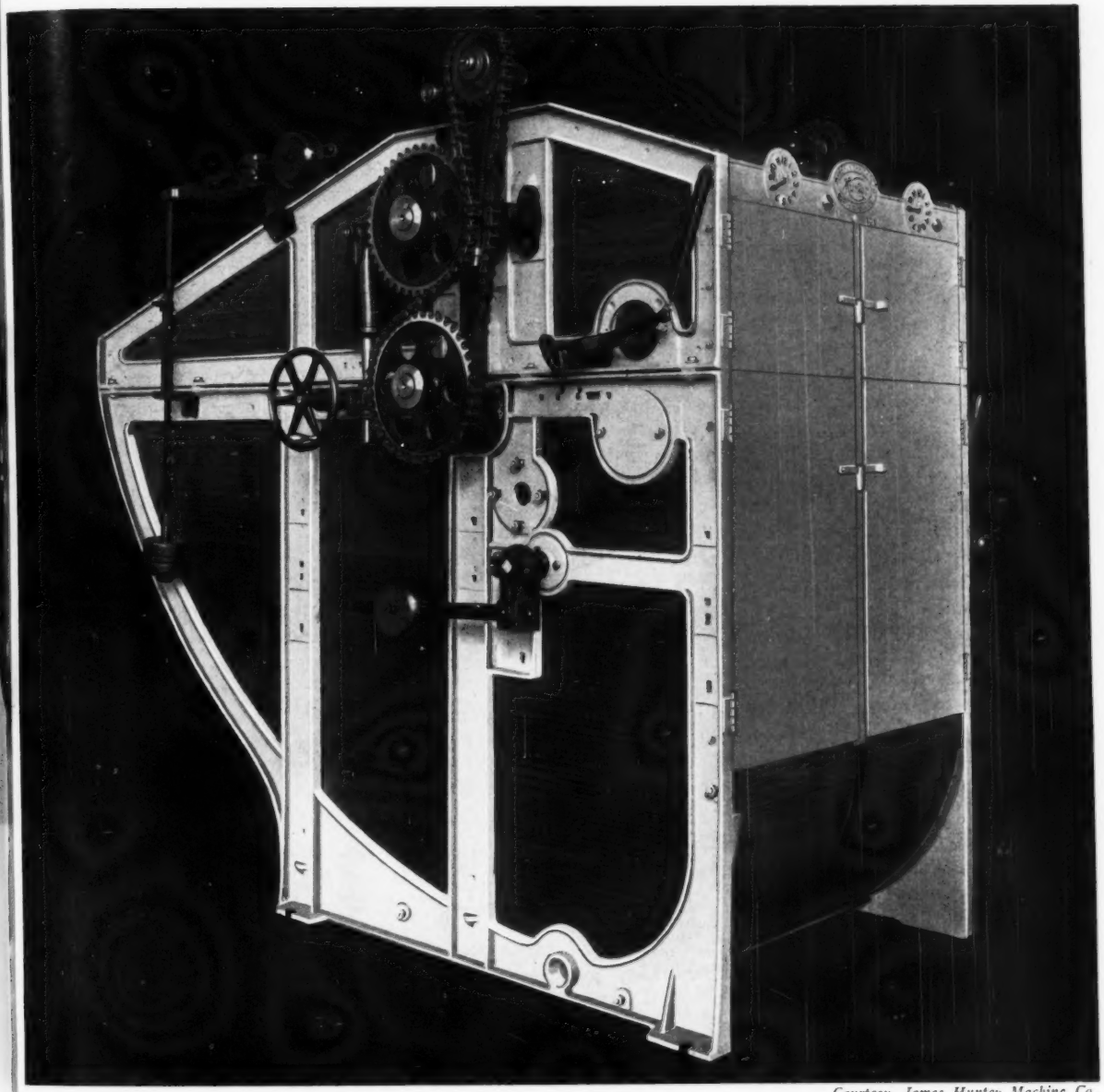
Tubular Knit Goods

LEO GLEKLEN

FOR several years the tubular knit goods industry has been growing and flourishing until now it has reached a stage where it demands attention. In the outerwear knit goods industry, the various natural and synthetic fibers are used so as to obtain very highly desirable effects that are difficult to obtain by the usual weaving methods. Light weight dress goods, such as worsted jersey, heavier weight fabrics for coating, cotton goods for the rubber-lining trade, viscose rayon and cellulose acetate rayon for the sports wear industry, are some of the types of fabrics that are manufactured on the various kinds of cylindrical knitting machines in the tubular form.

Each particular type of cloth and fiber needs a particular type of dyeing and processing, and where usual standard methods of dyeing might be employed for woven goods special consideration is often and usually necessary with the knit goods.

The dyeing and processing of worsted jersey demands some attention as large quantities are used both by the garment industry for sports and dress wear, and by the millinery trade. The tubular pieces weighing between 25-30 pounds for a 6-9 ounce jersey usually are scoured and given a light fulling preparatory to dyeing. Sometimes, the pieces are fulled first and then scoured, depending on the type of finish required on the face.



Courtesy, James Hunter Machine Co.

Knit Goods Washer.

These particular processes must be watched with care, for here, not only are the fabrics in their initial making, but also many difficulties arise which lead to faulty dyeing. If the pieces run in the mill are not shaken out after their run, fine wrinkles may develop in the course of dyeing which show up as thin, white lines which usually necessitates rehandling. This operation is merely a "breaking up" of the fibers on the face, and where heavy fulling soaps might be used, soluble oils and mostly water are usually employed to get the desired effect.

The scouring of these pieces is done in the usual way, but caution is employed to remove all traces of any soap which again might have an ill effect on dyeing. Many mills use a small amount of the new sodium hexa-meta phosphate in the last rinse water to counter-affect the results of possible lime formation and soaps that might be left in the goods.

The goods now processed are ready for dyeing. Usually, these pieces are run into a regular piece dye kettle and their ends sewed together in rope form. The safest method of sewing these ends is by using a regular long hand needle and tying them together with a cotton string so that the pieces will puff out or "balloon" in the process of dyeing.

The selection of dyestuffs for worsted jersey depends upon its use. If used for outerwear, fast-to-light acid colors are used, whereas for bathing suits, salt water requirements also are necessary.

(Continued on page 201)

Tub Dyeing and Package Dyeing

The Advent of Steam in the Dyehouse

NOEL D. WHITE

IF the boss dyer should today holler to a helper to bring an armful of wood, because his fire was getting low, everyone around would think he was crazy. That however was an everyday occurrence in the dyehouse less than 50 years ago. I know because "I was there." That was the time when dyeing was done in vats or kettles heated by building a fire under them, keeping it going until the dyeing was done, and wood was the fuel mostly used. To be correct there were also steam boilers used in those days in the larger plants, which very proudly announced the fact by displaying on their shingle the legend "Steam Dyeing" as a most modern innovation to attract the better trade.

All dyeing was done by hand even when steam was generally introduced, and for a long time dyeing machines had been the quest of dyers seeking to reduce time and labor, and also to improve the quality of the work by mechanical means.

Adhering to the principle of circulating the goods through the dyebath for best results, the first dyeing machines were introduced and adapted for cotton and wool yarns in skeins and warps or chain form. Then attempts were made to reverse the process and make the bath run through the goods, which was successfully applied at first in dyeing loose raw stock before being spun into thread. It was in this connection, where improvements were mostly needed, that the urge of a better method of handling the material was felt, which led to dyeing under pressure. A description of how a lot of raw stock was handled by hand will be interesting to the present generation of dyers.

RAW STOCK DYEING BY HAND

The raw stock in 200 lb. lots was put into a wire cage, built to fit into a rectangular vat; a scouring bath was prepared with soap and soda ash, in the case of wool stock, and the cage lowered into the bath. Then the work started. A man on each side of the vat, armed with a pitchfork, began moving the wool up and down and from one end of the vat to the other for about half an hour. The scouring bath was then dumped and the wool rinsed in two changes of water, with the pitchforks battling constantly; then the cage was lifted above the top of the vat to prepare the dyeing bath. The dyeing was done the same way, starting lukewarm, the bath raised to the boil with the wool in it and the pitchfork duet steadily in motion. When the desired shade was obtained the wool was rinsed and removed by putting it into bags to whizz it, and it was ready to be dried. This was done by spreading the stock on shelves in a drying room. Every lot dyed had several distinct shades in it, and when the wool was spun presented a mottled appearance, but it was probably used for heather or salt and pepper effect cloth, because there never was any complaints about it. Dyeing in nets, like hosiery was thought inefficient and poling seldom resorted to.

DYEING WITH STEAM PRESSURE

Now the raw stock is packed into a kier which is hermetically sealed and the scouring, washing, dyeing and finishing baths pumped into it, and circulated in and out through the stock from the first to the last operation with excellent results. This naturally led to package and beam dyeing in which the yarn is wound on cloth covered springs or perforated tubes or beams, and the liquor forced in and out of the yarn wound on them. Thus dyeing under pressure having been introduced, its feasibility having gained for this method the favor of the trade so much it is believed in some quarters that eventually package and beam dyeing will displace all other methods of dyeing.

However, this belief is open to question. Package dyeing is quite successfully done on all kinds of spun yarns like cotton, wool and spun silk; the fact that spun rayon is also being done with some success leads me to believe that these are the yarns best dyed in package under pressure. With further improvement, which undoubtedly will take place, it is quite possible that silk and all rayons will be dyed as well; however, time alone will tell about that.

IMPROVEMENTS IN DYEING MACHINES

In spite of the fact that dyeing has seen a great deal of improvement since the turn of this century there is still a lot of dyeing done by hand. Not so much on piece goods dyeing which, except for few and scattered instances, is almost exclusively done on machines. But much skein dyeing is still done in open vats, turned by hand over rods and naturally the question arises whether in this machine age it is possible that eventually all dyeing by hand may be done away with, as was done with many vegetable dyes.

There are cases where the dyehouse owner would like to adopt machine dyeing and the dyer is very much opposed to it. In a mill in New England where the production was about 800 pounds of yarn a day, all done by hand in lots of 5 to 100 pounds I thought I could use a couple of dyeing machines to advantage. Speaking to my employer about

(Continued on page 205)

PROCEEDINGS OF THE
American Association of Textile Chemists and Colorists

APRIL 15, 1940

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• CALENDAR • OF COMING EVENTS

Meetings, Council and Research Committee, National Bureau of Standards, Washington, D. C., April 19, 1940.

Meeting, Philadelphia Section, Penn A. C., 18th and Locust Sts., Philadelphia, Pa., April 26, 1940.

Meeting, New York Section, Swiss Chalet, Rochelle Park, N. J., April 26, 1940.

Meeting, Rhode Island Section, Providence Engineering Society, April 26, 1940.

Spring Meeting, Piedmont Section, King Cotton Hotel, Greensboro, N. C., April 27, 1940.

Meeting, Mid-West Section, Schroeder Hotel, Milwaukee, Wisconsin, May 4, 1940.

Meeting, Southeastern Section, Ralston Hotel, Columbus, Ga., May 11, 1940.

Annual Meeting and Convention, auspices New York Section, October 18th and 19th, 1940, Hotel Commodore, New York City.

Development of Synthetic Resins for Hosiery Finishes*

A. KEMPTON HAYNES**

I. INTRODUCTION

DURING the past few years the hosiery industry has become increasingly interested in resin finishes. It is but natural for us to ask ourselves why resin finishes are becoming a more and more important part of the hosiery industry's progressive outlook. There are numerous reasons for the increasing study and adoption of resin finishes.

1. Resin finished hosiery has an over-the-counter appeal. Resins, being elastic and pliable, resist mussing when hosiery is handled for packaging. Elasticity is an important part of the success of resin finishes. It can be readily seen that resin finishes blend themselves with the natural elasticity of the silk fiber. It is no longer necessary to load silk stockings with finishes which under handling break down leaving a lifeless and shapeless stocking. Certainly an important part of consumer appeal is the presentation of a stocking which will hold its shape from the time it leaves the boards until its eventual purchase. Resins will bend or flex with the silk thread or fiber and return with them to their normal position, thus keeping the wales and courses straight, adding to the sheerness and beauty of the stocking. All of these characteristics of resin finished hosiery aid in the all important function of selling silk hosiery over the counter.
2. Today time and effort are being expended in developing finishes which will resist snagging and abrasion, and will increase the strength and elasticity of silk stockings. Stockings vary in quality and construction. It is very hard to develop any one finish of which you can say to all mill men, "This is the answer to your finishing problem."

We have found that the careful study of the application of resins to hosiery of a given quality and construction is the best way to develop a satisfactory finish. By blending or combining resins it is possible to show favorable improvement of one or all of the physical tests to which hosiery is subjected. Resins show a great variation in their physical characteristics and give a very flexible range of desirable properties with which to work. Some of the resins are hard and film-forming. These aid in decreasing snags. Others being soft and highly elastic increase the flexibility and strength of the stocking. However, we intend to outline more in detail the application of resins and their aid in improving physical tests a little further along in this discussion.

3. We have just pointed out that resins can be employed to improve physical tests. Many finishes will improve physical tests. It is necessary in order to increase the life of a silk stocking, that the desirable properties of a finish remain with the stocking after washing. After the resin has been dried or set on the hosiery board it is difficult to remove, becoming a water insoluble product. This is particularly so when you consider the mild but numerous washes given a silk stocking. Resins are fast to washing on cotton flat goods, which receive a considerably more vigorous wash. All of this brings us to one conclusion. When imparting physical properties to a silk stocking which will show improvement on physical tests, it is necessary that the finish be resistant to washing, in order to increase the wearing life of hosiery. Increasing the life of silk hosiery is of real promotional value.

II. BRIEF DISCUSSION OF RESINS

What are resins? The definition of a resin is indefinite. Generally speaking we refer to a large group of chemical materials of undetermined structure, derived either from natural or synthetic sources, and formed by the combination and recombination of relatively simple chemical materials with themselves. Of this large number only a few are suitable for textiles because of color and unsuitability in mill processing. The synthetic resins which are of chief industrial interest and importance are usually organic condensations of resin forming substances which are sold or applied as water soluble powders or solutions, emulsions and dispersions. These products on drying, heating or exposure to air are quickly converted into much less soluble products.

There are two large groups of resins, thermosetting such as RHonites and thermoplastic such as RHoplexes. Thermosetting resins are insolubilized by heating to products which show little or no change of softness or flexibility with subsequent changes in temperature. Thermoplastic resins repeatedly soften with heat and harden with cooling. Resins or plastics may be hard or soft, brittle to elastic, colorless to black, transparent to opaque. Earlier in our discussion we spoke of the elasticity of resins and we just now mentioned brittle resins. Obviously in developing resins for hosiery finishing we may find it necessary to employ a brittle resin, but we can modify

*Presented at meeting, South Central Section, March 9, 1940.
**Röhm & Haas Company, Inc.

this type of resin by plasticizing with an elastic resin to impart a flexible finish. Those resins selected for textile application may be thermosetting or thermoplastic, must be colorless, odorless, and in a form which mills can handle on existing equipment and by well known methods.

While other types may become available in the future, today the thermosetting resin most suitable for hosiery use because of its clarity, lack of color, cost, availability and ease of handling is the urea formaldehyde type, whether in powder, solution or emulsion. Considering the same advantages, the thermoplastic types most suitable are the acrylates. These are sold entirely as dispersions, either anion or cation active, and are made in a range of degrees of hardness or softness.

III. APPROACH AND THE STUDY OF RESINS FOR HOSIERY FINISHING

A. Resins can be employed with the present day dullers and water repellents. Resins applied by themselves will impart some dulling, but water resistant resins are usually not water repelling. In combination with a duller or water repellent, or both, a resin will aid in improving the wash fastness of the repellent and duller. Whether any specific duller or repellent is compatible with a given resin depends upon the chemical formulation of each. This can be easily tested by a sample mixture in the proper proportions in a beaker. Combination of these products may improve appearance, physical tests, resistance to washing, and increase the life of the stocking. Knowledge of the properties imparted by resins alone allows specific recommendations to be made which come close to the results desired, and final adjustments are made by trial in the mill.

B. Unless water repellency is an important part of a marketing program, and a duller is essential, we prefer to apply resins alone. By blending resins it is possible to obtain any hand desired, from an extremely soft to a hard one. The application of resins alone or in combination with other resins usually shows a superior wash fastness to resins in combination with foreign materials. However, in some cases we have found that the addition of a water repellent or duller has even improved wash fastness, but generally speaking this is not true.

C. In developing a resin finish we have found that the best approach to the problem is the setting up of the standards we wish to obtain in the order of their importance; for example:

1. The final appearance of the finished hosiery.
2. Actual wear tests.
3. Improvement of physical tests.
   a. Snag resistance.
   b. Frazier test.
   c. Resistance to abrasion.
   d. Mullen's test.
4. Wash fastness of the finish.
5. Result of physical tests after washing.

Other tests can be made if desired, but the ones outlined seem, by a consensus of opinion, to be the most important. There may be some disagreement as to the order of the importance of the tests, this being a matter of personal opinion. It is essential for proper evaluation of results that tests be made in comparison with hose of the same construction and quality.

Having set up our standards, it is now our problem to meet the requirements.

(1) Developing a resin finish with a desirable hand and pleasing appearance depends on the amount of resin used and the proper blending of the resins. In the majority of cases a duller adds to the appearance of the finished stocking, especially those having a limited number of turns. The development of a pleasing finish, of course, depends on the type of finish desired by any particular mill.

(2) As good results on actual wear tests depend on obtaining the highest possible average on physical tests and the wash fastness of the finish, we shall discuss these subjects in relation to one another.

It can readily be seen that improved wear in actual use can be best obtained by blending resins so that the *average* result is improved for *all* physical tests, and that the improvement of one of these tests to a high figure, while the others are substantially unaffected, does not mean necessarily an improvement in consumer use. We do not believe that any one of the physical tests is a complete measure of results in use.

(a) In order to produce a resin finish resistant to snagging, we find it necessary to apply hard, smooth surfaced film forming resins. This type of resin forms a protective coating around the loose silk fibers and retards the penetration or ability of any sharply pointed object to pull or snag the silk fiber. This type of resin, however, will reduce flexing cycles and the distensibility or elasticity of the knitted stocking. It will aid in recoverability, or at least appear to do so simply because it retards distensibility.

(b) Lubrication, or the application of a highly flexible resin, will aid in improving elasticity or the flexing cycles of the knitted stocking. Lubrication can be accomplished by applying a cation active softener or a lubricating type resin. Dullers will decrease the flexing cycles because of abrasive action.

(c) Resistance to abrasion is best improved by the combination of a protective coating and lubrication. Therefore, if you obtain improved averages of snag resistant and Frazier tests by proper blending of resins, you should also have imparted a suitable finish to resist abrasion. Again, a duller causes greater frictional wear, being somewhat abrasive, but we depend on the lubricating resin or cation active softener to overcome partially this detrimental action.

(d) A tough, flexible, film forming resin is necessary to improve the tensile strength of a knitted fabric. We have found it very difficult to show any great improvement on Mullen tests. In some cases we have improved readings from 2-7 lbs. We feel that by keeping the Mullen test at least constant, and not decreasing it in any way, the result can be considered satisfactory.

Now that we have considered the application of resins individually to improve physical tests, you can readily see the necessity of working out a blend of resins in their proper ratios in order to arrive at the standards we have set. This can be done and is being done. As pointed out before, stressing great improvements on one type of physical test is a nice way to market hosiery, but it does not necessarily mean that the hosiery will show exceptional wearing qualities.

Several times we have mentioned a cation active softener such as Triton K-60 and at this point we would like to stress the importance of this type of product in finishing hosiery and particularly where resins are concerned.

In the first place, a cation active softener is an excellent lubricant. In the second place it helps to exhaust resins and other types of finishes, especially when they carry a negative charge. We have found that by applying this product in the first rinse after dyeing, a more uniform application of certain dullers can be expected, and at the same time an almost complete exhaustion of certain thermoplastic resin dispersions takes place. Through a uniform application and exhaustion the finished hosiery is greatly enhanced as to appearance and hand. Being a lubricant the cation active softener aids in boarding. We recommend this type of application to be made in the last rinse after dyeing, because its mordant action is quite powerful and the addition of a resin directly to a cation active solution may cause precipitation of the resin. By application in the last rinse the cation active material is exhausted on the silk fiber and additions of resins in the finishing bath can be made safely. We strongly recommend this application, no matter what type of subsequent finish will be employed.

IV. WHERE AND HOW ARE RESINS APPLIED?

In applying resins we have made no departure from the usual methods of application with the exception of a few isolated cases. The resins are applied as finishes after boiling off and dyeing, and are handled in rotary or paddle wheel machines. We find a satisfactory finishing time to vary between 10 and 30 minutes.

Thermo-setting resins require more heat for complete polymerization than thermoplastic resins. We have found that thermosetting resin finishes are best set by boarding on forms in the presence of external heat. Internally heated boards are satisfactory to insolubilize thermoplastic resins. A temperature of 200°-220° F. is considered satisfactory to dry thermoplastic resins, and we prefer a temperature of 250°-280° F. to insolubilize thermosetting resins. In some cases we have had objections to using high temperatures. However, through practical experience we have not observed any detrimental effect on silk hosiery. We do know that by prolonged exposure to high temperatures silk stockings are harshened and weakened. We have not found it necessary to prolong boarding and the speed of operation can be kept constant.

We depend on the polymerization of resins to produce wash fast finishes, and in combination with foreign materials we depend on chemical reactions or mechanical binding.

The cost of applying resin finishes is of course important. It is safe to say resin finishes can be applied at from 2 cents to 5 cents per dozen pairs. In this respect it is well to point out that an excess of a resin finish will make mechanical handling difficult.

Synthetic fibers are becoming widely used in the manufacture of hosiery. These fibers are used to construct a complete stocking or to replace part of a silk stocking. Stockings constructed of synthetic fibers have certain outstanding advantages, such as increased strength and resistance to abrasion. They also have disadvantages, such as snagging and lack of elasticity. These statements, of course, vary with the fiber used. Resin finishes can be applied to synthetic fibers with considerable success. The same factors regulating the application of resins to improve the physical properties of silk stockings can be used in finishing hosiery with synthetic yarns. Each fiber, either natural or synthetic, has certain outstanding characteristics and also certain faults. It is possible to select a resin which will introduce the characteristic which the particular fiber lacks and to impart this characteristic by finishing, so that an improvement of the fiber is brought about.

V. CONCLUSION

Summing up, we repeat that the hosiery trade has become interested in resin or plastic finishes because of the permanent improvement in appearance and physical life which can be imparted. To obtain these results on any given hose a study must be made of the proper blend to obtain a desired result. To an increasing degree mills are making this study and producing improved hosiery. Research has not ceased and will go on continually both in the chemical laboratory and in the mill. Improved results are being obtained today but we believe that continued experiment will result in even greater advances in the future.

I would like to gratefully acknowledge the assistance given me by Mr. H. F. Lawton and Mr. J. W. Jordon of our Philadelphia staff in the preparation of this paper.

DISCUSSION

Q—Can hosiery be stripped and redyed after resin finishes have been applied?

A—Yes. Actual experience has shown that no difficulty arises. The resin is not stripped, but as I mentioned in the paper, resins are not water repellent and the hose will

dye level when redyed. In some cases a dyer prefers to add a penetrating and leveling agent.

Q—In such a case will the hose need to be refinished?

A—As a rule, yes. The hand will probably not be the same as before unless the hose is refinished. However, the resin finish is still present and the finishing formula will have to be modified to take this into account. Laboratory tests show as much as 80 per cent retention of the resin finish.

Q—How can you analyze for the presence of resin?

A—This cannot be done definitely. Indications from which conclusions can be drawn are obtained by examining the hose before and after washing. Physical tests before and after washing and the weight of the hose before and after such observations give a clue as to whether a permanent finish has been applied or not. Weighings, of course, must be under carefully controlled conditions as the amount of finish on a single stocking is small. Urea formaldehyde resins can be analyzed for chemically by extraction with HCl.

Q—Is there any difficulty in boarding?

A—Boarding conditions are governed by the particular blend applied. If a large quantity of a soft thermoplastic resin is used, there may be some difficulty. However, such amounts would probably give an undesirable hand and are unlikely to be met with. Selection of resin and lubricant control this condition.

Q—Do resin finishes affect the shade of hosiery?

A—Not as much as finishes regularly used. It is well known that most water repellents affect the shade and this is allowed for. In the same way any slight effect of resin can be allowed for.

Q—Will the use of resins affect equipment (i.e., be corrosive or gum up machines)?

A—No. Resins are inert chemically and in the form supplied have not been difficult to handle in any way.

Q—Do resins affect the fastness of colors?

A—This is uncertain. It is almost sure that urea-formaldehyde resins improve wash fastness of certain dyes, but these have to be examined individually. It is sure that fastness is not decreased by any resin.

Textile Fibers

*Old and New**

WILLIAM H. CADY**

WHEN a man is asked to give a talk, if possible he selects a subject on which he is an authority, and which naturally requires little preparation on his part. Unfortunately your present speaker is not an authority on any subject, consequently I decided to select a topic of which I knew very little, figuring that by the time I had completed the necessary reading preparatory to writing the paper, I would have learned something myself, at least.

I have to admit at the outset that there is nothing original in this paper; nothing but what anyone can find in the literature if he wants to take the trouble to look over a hundred or more books and journals. Also since I am giving you this information "second-hand," so to speak, I cannot vouch for its complete accuracy, and will have to fall back on that overworked but very useful phrase which is found at the bottom of all dyestuff circulars: "Without Guarantee."

Your speaker has wanted for some time to catch up with the flood of journal articles which have been appearing during the last two or three years, dealing with the various new fibers, which are getting so numerous that the average person is bewildered. In one recent article alone there were listed 45 different viscose fibers, all but two made in Germany or Italy and all carrying different trade names. While anyone who has the time and patience can extract and absorb this voluminous literature, few are willing or able to do this. It therefore seemed desirable to bring together within the confines of a 50 minute talk references to all of the new fibers which appear to be sufficiently important and sufficiently dissimilar to be worth recording, with a brief statement of the manufacture, properties and uses of each, so that the aforesaid average person may comprehend a little better just what is happening. Because it is a fact that great things are happening in this textile world of ours; new discoveries and inventions every day, which are bound to make radical changes in the industry; and it is well for us to keep pace with these new developments if we are to remain in the picture.

Before we start to explore the possibilities of the new fibers, however, let us take a parting glance at the old

*Presented at meeting, New York Section, March 1, 1940.
**Chief Chemist, U. S. Finishing Co.

ones. After all there were only about four of them, cotton, wool, silk and flax, which were used to any great extent from the very earliest times down to the end of the last century. Isn't it quite remarkable that these four fibers have filled practically all the needs of mankind (and womankind) for clothing ever since fig-leaves went out of fashion! But how much do we actually know about the clothing which was worn, say, in Biblical times? You have all heard of Joseph's "coat of many colors." Have you ever had any curiosity to know what the coat was made of? What kind of "raiment" do you suppose King Solomon "in all his glory" was arrayed in? And what variety of dress goods did he provide for his 700 wives and 300 concubines? What sort of fireproof material did Shadrach, Meshach and Abednego have on when they were cast into the "burning fiery furnace" by King Nebuchadnezzar, and came out of it (according to the book of Daniel) without singeing a hair? I am sorry that I do not have the answers to these questions; but we will dig into the past as far as the written records will permit us, and I will try to tell you how each of the ancient races started its own textile industry with whatever materials were available in that part of the world; flax in one country, wool in another, cotton in another, and so on. Then I will take up the new fibers, and try to show you how they compare with one another and with the older ones; what their advantages and their disadvantages are, and what are the prospects of their ultimately displacing the natural fibers in part or altogether.

Before we go any further we need a definition. What is a textile fiber? Because every fiber is not adapted for textile purposes. For example some fibers are too short, or too stiff, or too weak, or not produced in sufficient quantities to be practically useful. Matthews has listed ten fundamental properties which a textile fiber should possess in some measure: 1. Tensile strength; 2. Length (sufficient to enable a bunch of fibers to hold together when spun into yarn); 3. Cohesiveness or frictional resistance (to prevent slippage of one fiber on another); 4. Elasticity and pliability; 5. Fineness; 6. Uniformity of staple (both in length and in diameter); 7. Porosity (or the ability to absorb liquids); 8. Luster; 9. Durability (such as resistance to wear); 10. Commercial availability. To these we might add other properties of equal importance, such as physical and chemical stability and affinity for dyes. The extent to which any particular fiber possesses some of these fundamental properties determines its usefulness for a particular textile purpose.

What is the oldest textile fiber? I am sorry to say that the authorities are in disagreement on this point. Matthews, in his "Textile Fibers," states that the use of flax or linen is probably older than that of any other fiber; that the cultivation of flax and its conversion into yarn go all the way back to the stone age in Europe, when mammoths roamed the earth. On the other hand, Trotman claims that cotton is the oldest of the textile fibers, and archeologists tell us that samples of cotton fabrics of excellent quality have been found in excavations in Asia and South America which date back thousands of years, long before the beginnings of what we call history. Silk also may claim extreme antiquity; according to Trotman, silk-worms have been cultivated in China ever since 2600 B.C., and the use of silk as a textile fiber was perhaps known long before this. Ramie or China-grass is another very ancient fiber, and was used in India and China before there were any written records. As to wool, it was in regular use in Mesopotamia as far back as 4000 B.C. It must be remembered that these ancient civilizations in Egypt, India, Mesopotamia and China, in spite of the fact that they were all flourishing at about the same time, had absolutely no intercourse with one another in those very early days, and whatever knowledge of textile operations each acquired was not shared with the others until later. This makes it easier to understand why one country used only linen, another only wool, and so on.

All things considered, it would seem that the prize for antiquity should go to linen. At any rate, flax is known to have been cultivated in Egypt fully 5000 years ago, and for centuries it was the only textile fiber in that land. It is mentioned several times in the Old Testament, where we read that Pharaoh dressed Joseph "in vestures of fine linen," and that the hail-storm which the Lord sent to punish Pharaoh destroyed the flax crop. Down to 1500 B.C. the linen was undyed, but in later years it was colored with vegetable dyes, largely safflower, woad, dyer's thistle and perhaps madder, and other dyes which are not known to us today. The popular colors appear to have been various shades of blue, yellow, red and purple. The standard garment for everybody was originally a simple loin cloth. Even the King wore no other dress, but a lion's tail hanging down behind him was the outward symbol of his rank. It is interesting to note that even the loin cloth was subject to changes in fashion, being sometimes longer and sometimes shorter, just like the modern skirt. Large quantities of linen fabrics were also used as wrappings for the mummies, and samples of these cloths have been found in tombs, some of them 4500 years old, and still retaining the original dyes. The cultivation of the flax and the spinning and weaving of the linen were illustrated on the walls of Egyptian palaces, temples and tombs.

In later years the use of linen spread to Greece, and eventually to Rome, where it was used for women's clothing and handkerchiefs, also for ship sails, but probably not for outer garments. The historian Pliny in his "Natural History of the World," written about 50 A.D., has much to say about linen and its manufacture, and tells how the woven cloth should be "beaten with good club-headed cudgels," and says "the more injury that is done to it, the better it is." It is a pity that the same cannot be said of our modern fabrics. Pliny also gets us excited by

describing "a kind of linen which will not burn." He says "I myself have seen . . . table-cloths . . . cast into the fire, and there they burned before our face on the hearth . . . and yet no part of their substance . . . was burned away. This kind of linen grows in the deserts of India where no rain falls, where the country is all parched and burned by the sun, which is the reason why it will stand the heat of the fire." Then Pliny explains the mystery. "In Greece" says he "they call this linen 'asbestinum.'". In other words, what Pliny took for a vegetable fiber was nothing but asbestos. As Josh Billings, the humorist philosopher, once remarked, "It is better to know nothing than to know what ain't so."

In Mesopotamia, by contrast to Egypt, wool was practically the universal fiber in the earliest days. This was partly due to the fact that the country was particularly adapted for sheep-raising; also the inhabitants needed warmer clothing and more of it than the Egyptians. However, there is reason to believe that both cotton and flax were also used there to some extent. At first the usual garment was a goat- or sheep-skin, covering the lower part of the body, but by 3000 B.C. real woolen clothing had made its appearance; a sort of two-piece suit, consisting of a long under-garment or skirt and an outer garment or shawl several yards in length, with long fringes. As time went on, these garments became modified, developed sleeves and other improvements, and gradually acquired color, and in the case of royalty, special decorations, probably embroidered. The colors were principally purple, blue, red, brown and gold, but unfortunately we have little knowledge of the dyes that were used. The wool was generally dyed in the raw state. In addition to clothing, tapestries were also made of wool and frequently ornamented with elaborate designs. All in all, Mesopotamia probably had the most highly developed textile industry of its time.

In ancient Greece also, wool was the important textile fiber, and was dyed in various colors in which the Tyrian Purple and a red made from Kermes predominated. Sparta was an exception, however; there dyeing was looked upon as a falsification of nature, because it robbed the wool of its natural color. In fact, the Spartans had one word meaning both "to dye" and "to deceive." Nevertheless, the Spartan soldiers had their uniforms dyed scarlet, so as to prevent the blood from showing when they were wounded, which in itself seems like a bit of deception. The standard men's wear in Homer's time consisted of a woolen shirt or smock, reaching to the knees or ankles, and supplemented by a woolen cloak in cold weather. Women and high dignitaries wore cloaks made of linen, presumably imported from Egypt. The ancient Romans were also wool-users. The usual garments for men were a tunic, somewhat resembling a shirt, and a toga or mantle, several yards in length, which was carefully draped around the wearer according to prescribed rules. The toga was permitted to be worn only by Roman freemen, and was decorated with purple stripes when the wearer was a public official. Both of these garments were made of wool.

In the book of Deuteronomy, as some of you may remember, Moses lays down the law to the Children of Israel, and in addition to the Ten Commandments, gives them a long list of rules and regulations which they must obey by order of the Lord, or else . . . One of these regulations reads as follows: "Thou shalt not wear a mingled stuff, wool and linen together." It is hard to understand this, and it almost seems as though Moses had misquoted the Lord. We wonder what Moses would have thought of the modern three and four fiber hosiery.

Cotton seems to have made its first appearance as a textile fiber in India. Brown states that fragments of cotton cloth and string have been found in excavations in North-west India which date back at least to 3000 B.C. How the cotton was spun in these pre-historic times we can only guess. The first actual record we have of cotton fabrics in India was dated about 800 B.C. There is a scarcity of information as to whether the early inhabitants dyed their cotton fabrics or not, but we know that by the fourth century B.C. the art of printing cotton cloth was being practiced in India. In fact, it was probably in that land that textile printing had its beginning. After Alexander the Great conquered India (about 325 B.C.), he carried back with him cotton cultivators and craftsmen to Asia Minor, where they settled down. From there the use of cotton seems to have spread to Egypt, although it was apparently not used in the tombs as mummy-wrapping until the 8th century. There is evidence that the Egyptians practiced cotton printing as early as the 4th century. Pliny wrote about 50 A.D.: "The upper part of Egypt produces a shrub known by some as Gossypium. The shrub is small and bears a fruit similar in appearance to a nut with a beard" (not a bad description of a cotton boll), "and containing in the inside a silky substance, the down of which is spun into threads." He further states: "There is no tissue known that is superior to those made from this thread, either for whiteness, softness or dressing; the most esteemed vestments used by the priests of Egypt are made of it." It is interesting to note that cotton also made its appearance at a very early date in South America. This is indicated by the grave cloths which have been found in Peruvian excavations, of unknown age but showing a high degree of technical development.

The use of silk seems to have originated in China, where it has been cultivated certainly since 2600 B.C. and probably long before that. There is a Chinese legend that Princess Si-ling-shi discovered how the silk filaments could be unravelled from the cocoons, sometime in the 27th century B.C.; but the real origin of the silk industry is lost in the remote past. In the ancient Chinese chronicle of Chocking there is a reference to dye-houses as far back as 3000 B.C. Naturally little is known of the dyes

themselves, but one old document tells us that red was made by combining safflower, dried plums, caustic soda and the ashes of rice, shaded if desired by the addition of sumac. This formula is not in the modern dyer's repertory. There is another Chinese legend that the Emperor Fo-hi, who reigned about 3000 B.C., had silk strings on his musical instruments, and that his son used silk strings for fish-lines.

We are told that the use of silk for wearing apparel in China was confined to the imperial family for many centuries (which leaves us in the dark as to what the rest of the population wore). The rules of etiquette required that the Emperor should wear robes of white silk in his palace, and colored robes in the royal processions and on special occasions. The Emperor's robes were yellow, the color of the sun. His principal wife and his oldest son also wore yellow; the other wives, and court officials of the first rank, wore violet; second and third rank officials, red; and common folks, black.

For many years silk cultivation was confined to China, and it did not reach Japan, the modern silk-growing country, until the third or fourth century A.D. The ancient Greeks were not acquainted with silk, but the Roman women of Pliny's time wore "fine silks and velvets" which were no doubt imported from the East. Cleopatra is said to have worn a silk dress which was woven in China, dyed in Asia Minor and embroidered in Egypt. The use of silk for men's clothing, however, was considered effeminate, and was forbidden by the Emperor Augustus.

Mention should also be made of the so-called "wild silk," which differs from the cultivated silk only in that the wild silk-worms are not so particular about their diet as the cultivated ones, which feed exclusively on mulberry leaves. Wild silk, of which the best known is Tussah, was used in India in quite remote times, but details are lacking.

Three other ancient fibers may be briefly mentioned. Hemp was cultivated in Europe from the earliest historical times. Herodotus wrote in 450 B.C. that the Thracians wore garments made of this fiber. Pliny also referred to it, but only as material for ropes, for which purpose it is of course still used. Broom was another ancient fiber which was used largely for cordage and was said to be even better than hemp, especially when used wet. It was a native of Spain, and Pliny tells us that the poor shepherds were clothed in it. In this connection, it was announced three years ago that an Italian firm was working on the production of fibers extracted from this same broom plant, and that it was hoped that this material would displace all of Italy's requirements in cotton; probably wishful thinking on the part of somebody. Ramie, or China-grass, as it is sometimes called, is also one of the oldest fibers. Centuries ago it was used for clothing in China and for rope in India, and was prized because of its tensile strength and luster.

It would be interesting to trace the progress of these various fibers through the centuries down to the present time, but our time is too short. We will therefore hurdle a few hundred years, and stop at the year of our Lord 1665. A curious book was published in England by Robert Hooke in that year, entitled: "Micrographia, or Some Physiological Descriptions of Minute Bodies, Made by Magnifying Glasses, with Observations and Inquiries Thereon." If we read Observation No. 4, "Of Fine Waled Silk or Taffety," we find the author describing the appearance of a silk thread under the microscope, and contrasting its clear transparency and vivid light reflection with that of other fibers, such as linen. He remarked that silk seemed to be "little else than a dried thread of Glew," and added "I have often thought that probably there might be a way found out to make an artificial glutinous composition much resembling, if not full as good, nay better, than that excrement, or whatever the substance it be out of which the silk-worm wire-draws his glew. If such a composition were found, it were certainly an easy matter to find very quick way of drawing it out into small wires for use. I need not mention the use of such an invention, nor the benefit that is likely to accrue to the finder, they being sufficiently obvious. This hint therefore may, I hope, give some ingenious person an occasion of making some trials, which if successful, I have my aim, and I suppose he will have no occasion to be displeased."

Apparently no "ingenious person" took this hint for quite some time, but half a century later we find Reaumur, the French physicist, thinking aloud on the same subject. He wrote in 1710: "Silk is only a liquid gum which has been dried; could we not make silk ourselves with gums and resins? . . . It has already been proved that it is possible to make varnishes that possess the essential qualities of silk . . . But how can we draw out these varnishes into threads?" This question remained unanswered for over a century, but eventually the idea of making artificial fibers by imitating the functions of the silk-worm began to take root in the minds of others, and from 1840 on, various investigators were working on the problem. It was finally solved in 1884, when Count Chardonnet patented his process for making continuous silky filaments from cellulose nitrate by forcing a solution of it through tiny holes, and subsequently regenerating the cellulose by denitration. This was the first "man-made textile fiber," and it opened up a new era in the history of textiles.

For the next half century chemists and physicists all over the world studied the cellulose molecule and experimented with all sorts of methods for making continuous filaments from it. There are only three of these methods (besides Chardonnet's, which is now practically obsolete) which have been commercially successful, namely, the viscose, cuprammonium and acetate processes. I will not attempt to describe these in detail, since they are so well known, but would like to mention a few important recent developments in these older synthetic fibers, which are the only ones which may properly be called "Rayons":

First, the spectacular growth of staple fiber, or rayon cut into short lengths and subsequently spun into yarn like cotton or wool. Second, the numerous attempts, some quite successful, to produce a permanent wool-like crimp in viscose and acetate fibers. Conspicuous examples are "Teca," an acetate rayon manufactured by the Tennessee Eastman Corporation, and Vistra XT of the I. G., made from viscose. Third, the production of stronger and better rayon yarns by means of the stretch spinning process, that is, stretching the fibers to several times their original length immediately after they are formed, and while they are still in the plastic state. In this category of stronger fibers are "Tenasco," made by the American Viscose Corporation, "Cordura" of DuPont, both continuous filaments, also "Fibro" of American Viscose and two German products, "Lanusa" and "Schwarza," these last three being staple fibers; also probably "Forte," the acetate fiber made by British Celanese, Ltd. "Cordura" will be remembered as the yarn from which the famous quadrilateral jib of the yacht "Ranger" was made. These strong rayons are finding increasing use in heavy duty automobile tires, also for football suits, sports clothing and many other purposes. It has been found that tires made with "Tenasco" do not heat up as much in actual service as tires made with cotton, and are better able to withstand sudden shocks. This is due to the fact that the synthetic fiber, being smoother, produces less friction with the rubber and is also more elastic.

A few more new fibers belonging to this same family should be mentioned here. First, an all-viscose product closely resembling wool in its physical properties, made by the so-called "Kohorn" process, is reported from Japan. We know nothing of the process of manufacture, but the fiber is said to have an elastic elongation equal to wool, a permanent curl, and equally good heat-insulating properties. Next, a fiber known as "Hofa," apparently a mixture of viscose and wood fiber, is being made in Germany. It is a coarse filament, similar to horsehair, and is intended as a substitute for hemp, jute, etc. Finally, "Telusa," another German product, is a staple fiber made by combining the viscose and cuprammonium processes. It is alleged to have a tensile strength equal to wool, and a permanent crimp.

It should be noted that all of the "man-made fibers" so far mentioned are fundamentally cellulose products; in other words, the cellulose which existed in the raw material (cotton or wood pulp) is still cellulose in the finished product, and nothing new has been created in the true sense. From 1934 on, we find textile research heading in a different direction, in an attempt to create fibers out of non-cellulosic materials. Some of these researches were inspired by economic necessity; for example, the Italian Government realized the importance of finding a substitute for wool, as one step in its campaign to make Italy economically independent of other nations. At all events, during the last few years the production of new fibers in the laboratories of the world has been proceeding at full speed, and some of them have attained much commercial success as partial or complete substitutes for wool in those countries where wool is scarce. In this connection it must not be forgotten that some pioneer work on these new processes was done a generation or more ago; thus, gelatine, casein and albumen were all tried as materials for fibers as far back as 1904, and even resin fibers were being experimented with as early as 1912.

The first non-cellulosic synthetic fiber to reach large-scale production was casein wool, made in Italy by a process patented by Antonio Ferretti in 1935 and named "Lanital," a combination of "Lan" (from "lana," or wool) and "Ital" (for Italy); i.e., Italian wool. It is rather difficult to learn the exact process as it is at present carried out, because no two writers appear to be in agreement; this is probably because the original process is constantly being improved. Briefly, the fiber is made from casein, which is obtained from skim-milk by precipitation with acids. The casein is dissolved in caustic alkalies and is forced through spinnerets into hot sulfuric acid containing zinc or aluminum salts, in which the casein is coagulated into filaments. It is customary to stretch the filaments at this stage in order to improve their tensile strength. They are then cut into short lengths and immersed in a solution of formaldehyde and common salt, where they remain for several hours. This treatment makes them more insoluble, and more resistant to the usual chemical processes met with in textile plants.

Casein wool has a strong similarity to sheep's wool in its chemical constitution, the chief difference being a low sulfur content. The fibers, however, are smoother, and lack the scaly surface which is characteristic of real wool, and in consequence have little felting power. The general handle of casein wool is soft and quite similar to sheep's wool, and the resistance to creasing is about the same. Casein wool has a lower specific gravity than real wool, and one method of fiber analysis is based on this fact. If a mixture of the two fibers is suspended in a mixture of carbon tetrachloride and toluol having a specific gravity of 1.3, the casein fiber rises to the top while the wool sinks. It is interesting to note that casein wool is not attacked by moths. It is, however, susceptible to certain bacteria which under favorable conditions may actually dissolve the synthetic fiber, leaving real wool unharmed. The tensile strength of casein wool is not more than 50 per cent as great as real wool, and boiling in water tends to lower it still more.

Tinctorially the casein fiber has similar properties to wool, but it absorbs dyes more rapidly and at a lower temperature. The dyeings, however, are not as fast to washing or to perspiration as corresponding dyeings on wool. As a rule, less acid is required in the dye-bath. It is necessary to avoid boiling baths and to use care in the selection of dyes, as some wool dyes give quite abnormal results on the synthetic fiber. Casein wool is considerably

more resistant to alkalis than real wool, so that it may be dyed with sulfur and vat dyes; but the alkalinity of the bath should be kept low.

Casein wool has apparently found its principal use in mixtures with real wool, and the Italian Government is reported to have authorized the employment of 70 per cent wool and 30 per cent Lanital in both army and navy uniforms. As a result of the success of Lanital, several other countries have started the manufacture of casein fibers. Holland has produced "Lactofil" and "Caselana"; Germany, "Tiolan"; Poland, "Polana" (probably it has another name by now); Belgium, "Cargau," and England, "Casein Fiber." The United States Government has also granted a patent covering a similar process, which, however, has several advantages over Ferretti's. The patent was issued to Whittier and Gould, and is dedicated "to the free use of the people of the United States." This improved process has not yet been put to commercial use, but as this country has large amounts of skim-milk which are now being fed to farm animals, it would seem likely that a casein wool industry, if established here, would at least not lack for raw materials.

Several fibers composed of casein mixed with viscose are in use in the various countries, particularly in Europe. As examples, "Cisalfa," an Italian fiber, and "Fibramine," a Belgian one, are said to contain 4.5 per cent casein, the balance being viscose. "Lacisana," another Italian fiber, has only 3 per cent casein. Owing to their protein content, these fibers have some affinity for wool dyes, and therefore have possibilities for cross-dye effects when mixed with other fibers. In other respects, however, they are essentially the same as viscose.

On account of its limited tensile strength and other deficiencies, it is difficult to see how the casein fiber can compete directly with real wool in a country whose textile manufacturers are free to make their own choice of materials. Still, the casein wool has been much improved in the last few years, and in time these defects may be remedied. The writer well remembers how extremely weak the original "artificial silk" yarns were, forty years ago, when contrasted with a modern stretch-spun viscose, for example. From an economic standpoint it has been pointed out that while a sheep is producing only seven or eight pounds of wool, a cow is producing 100 pounds of casein (not to mention the cream). Wool suffers another disadvantage in that the diameter of the fiber varies in different parts of the sheep and in different seasons, and the individual fibers are not uniform from end to end and vary in length. Further, wool as it comes from the sheep is full of dirt and burrs, which must be removed by scouring and carbonization. Casein wool, on the contrary, like all synthetic fibers, is always uniform, free from impurities, and made of any length and diameter which may be required for a particular purpose. Its future development will be worth watching.

The progress made with the casein fibers has inspired other countries where milk is not so plentiful to experiment with other substances rich in proteins; some of these we will consider briefly. Perhaps the most promising is the soy-bean, of which large quantities are produced annually, particularly in Japan and Manchukuo, and more recently in this country. The Ford Motor Company has been using much soy-bean oil in its paints for a number of years, and has now developed a method for extracting the protein from soy-bean meal and converting it by a secret process into a viscous solution which can be forced through spinnerets into an acid coagulating bath. The fibers so formed are said to resemble casein wool generally in their physical, chemical and dyeing properties, and in their resistance to moths. The Japanese have also done much work in the same direction, and it is reported that a soy-bean fiber is already being marketed by a Japanese company under the name "Silkool." Details concerning its physical and other properties are not yet available. A group of English scientists have patented still another process for producing fibers from the protein of soy-bean, castor-bean, etc., in which use is made of the solubility of these proteins in aqueous urea. A solution so made, and containing in addition formaldehyde, gelatine and other "spinning auxiliaries," is spun into an acid bath containing certain inorganic salts, which coagulates the filaments. They are then further treated with glycerin and hardened with formaldehyde. This process has probably not yet been used commercially. Still another fiber in this group is "Mazein" obtained from zein, a vegetable protein contained in corn-meal. This is patented by the Corn Products Refining Company, who claim that its wet strength is better than that of the synthetic cellulose fibers, that it has good elasticity, and that it can be colored by adding spirit soluble dyes to the zein solution. The zein is dissolved in alcohol, formaldehyde and suitable plasticizers are added, and the solution is spun dry. The filaments are later strengthened by a heat treatment.

While Italy milks the cow and Japan shells the bean, Germany seems to go fishing for its proteins. Hiltner and Mecheels have described a German process for the preparation of pure, odorless fish protein and its use in the production of textile fibers. Apparently the fish protein is not used by itself, but only when mixed with viscose. When a mixture of this sort is spun into a coagulating bath, the viscose solidifies first and the protein later. This makes a fiber with a cellulose core and a protein surface, which can be dyed with acid dyes. Owing to the war, information regarding the properties of this interesting fiber and its commercial possibilities is very meager.

Another fiber which can hardly be called synthetic but is certainly new in the textile sense is reported from Germany. "Carnofil" is a protein product obtained from horse or ox muscle, which is already being employed for surgical purposes as a substitute for catgut and to a limited extent for textiles. The muscle is treated with certain chemicals to remove soluble substances, and is then disintegrated. Fibers are obtained, said to be as fine as vegetable fibers. They are carded and spun, either alone

or better in mixtures with wool, using up to 20 per cent of the muscle fiber. Fabrics made of this new type of union material (union of ox and sheep) are said to dye as well as all wool, and to have a similar appearance. It is also possible, according to a German article, to make a fiber by treating animal hides with swelling agents and forcing the pasty mass through spinnerets under pressure. The filaments so made are dried and treated with tanning agents to make them waterproof. This may be the "Marena" fiber, mentioned in the German journals. Still other fibers have been produced from hair, wool and horn by treating these substances with alkali and adding the resulting product to viscose, which is then spun in the usual manner. A fiber containing as little as 3 per cent of this nitrogenous matter is said to have affinity for acid dyes. It is also reported that the Japs have made an artificial fiber from whale meat, which is fermented in a chemical solution (composition not revealed) and reduced to a viscous mass which is then spun like the rayons. This sounds like another fish story. So far the process appears to be limited to laboratory experiments.

The growth of the synthetic resin industry during the last generation has been quite phenomenal, and it was natural that attempts should be made to use these new materials for fiber-making. This work has proceeded along two lines: attempts to manufacture an all-resin fiber, and attempts to incorporate resins in other fibers, particularly viscose, in order to obtain new affinities for dyes and more nearly imitate the physical properties of the wool fiber.

The first all-resin fiber to appear was "Vinyon," still in its infancy and only recently in large-scale production, but already well-known to most textile chemists who read the technical journals. Vinyon, as Dr. Bonnet has recently told us, is produced by the simultaneous polymerization of vinyl chloride and vinyl acetate. The product of this reaction, which is a white powder, with a molecular weight of 15,000 to 16,000, is dispersed in acetone and spun dry, like acetate rayon. The filaments, after standing twelve hours, are twisted and stretched and wound on spools, the stretching operation increasing the tensile strength and elasticity of the fibers. They are then set by immersion in water for several hours, and are ready for use. The fibers will be produced both in continuous filaments and as cut staple.

The properties of Vinyon include an elasticity equal to silk; a tensile strength much superior to most rayons and as good wet as dry; and good resistance to water, acids and alkalis. It is soluble in some organic solvents but unaffected by most. It is practically non-inflammable, and not attacked by bacteria or fungi. It has one serious drawback; it is thermoplastic, starting to soften at temperatures well below 100° C., which makes dyeing difficult and hot pressing impossible. It has been found that a mixture of 15-20 per cent Vinyon and the balance cotton makes a very satisfactory felt, which in some respects is superior to that made from wool, and is now being manufactured by the American Felt Company. Vinyon has also found uses for filter fabrics, fish-lines, electrical insulation, fire-resistant awnings and draperies, shower-curtains and hosiery, to mention only a few.

A really satisfactory method of dyeing Vinyon has not yet been announced; the ordinary dyeing methods used on other fibers are not suitable. It will be recalled that the manufacturers of acetate rayon were faced with the same dyeing problem when that fiber was first introduced, and it was solved only by making a special family of dyes with good affinity for the acetate fiber. Probably the needs of Vinyon will be met by the dye chemists in the same manner. The yarn can, however, be colored within certain limits by adding suitable pigments to the resin before spinning. Further developments with this entirely new and virtually untried fiber will be awaited with great interest. The yarn will be manufactured by the American Viscose Corporation from resin made by the Carbide and Carbon Chemicals Corporation.

A similar fiber is described in the foreign journals under the odd name "Pe Ce," which is being made in Germany from polyvinyl chloride and with typical modesty is claimed to be superior in fineness, strength and appearance to the natural fibers and the other synthetic ones. Experiments have been in progress for over five years, and it is reported that a plant for commercial production is being built. We are told that the new fiber is not attacked by acids, alkalis or bacteria, and has high elasticity and low inflammability, but that it cannot be boiled or ironed and shrinks when heated above 80° C. These properties are almost identical with those of Vinyon.

Attempts to incorporate synthetic resins in other fibers, particularly viscose, have been numerous in the last few years, and as a result several new fibers have appeared. The exact resins employed in these new developments are unknown to the writer, but urea-formaldehyde, phenol-formaldehyde and vinyl resins have all been found useful, and especially those resins which contain free amido groups, which provide the maximum affinity for wool dyes. One of the most important fibers in this group is "Rayolanda WD," made by Courtaulds, Ltd. It may be dyed successfully with a wide range of acid and chrome dyes; formic acid is preferred to sulfuric acid for this work. The fiber has even more affinity for direct dyes than those made from viscose alone, but the shades are said to have a somewhat reduced fastness to light. Like casein wool, Rayolanda can be dyed at a much lower temperature than wool. Mixtures of Rayolanda and wool are ordinarily dyed at the boil, and solid shades can be obtained if the dyes are carefully selected. Rayolanda may also be dyed with sulfur dyes. The yarn has a soft, warm, wooly hand and a low luster, and is more water-resistant than the viscose fibers. "Rayolanda X," made by the same firm, differs from WD in having less affinity for wool dyes and is used mostly for two-tone effects in mixtures with wool. "Vistralan,"

made by the I. G. in Germany, is a similar product, having in general the same properties as Rayolanda WD. "Artilana" is another German fiber of this class, but differs from Vistralan in that the fiber after spinning is given a crimp, and then is treated with resin to fix the crimp. This treatment gives it a lofty hand, very much like wool, but the affinity for wool dyes is definitely less than that of Vistralan or Rayolanda WD. The extra resin treatment is said to give the fiber anti-crease properties.

We come next to a fiber which has only recently appeared on the market, but judging by the articles which have flooded the technical and other journals, is destined to have a great influence on the future of the textile industry. "Nylon," as the new fiber is called (for no particularly obvious reason) was produced in the laboratories of the DuPont Company not so long ago, after several years of intensive research. It is described as "a super polyamide, prepared by condensing a dibasic acid with a diamine." This results in the formation of very long chain molecules; the molecular weight of these compounds is said to be from 7,000 to 20,000. The process for making the fibers is interesting because it is so unusual; the raw materials are mixed and heated to 180-300° C. until polymerization is complete. On cooling, the product, which consists of white ribbons, is broken up and reheated to over 200° C. and forced through spinnerets at this high temperature to form rather coarse fibers which quickly solidify. These fibers are then stretched cold to several times their original length, thus becoming much finer and stronger. They are now ready for use.

Chemically nylon resembles natural silk, but physically there are important differences. Nylon has a higher tensile strength, both wet and dry, and a greater elasticity. On heating to 240° C. the fiber melts. It is insoluble in most organic solvents but dissolves in a few, including phenol and formic acid. Boiling in 5 per cent hydrochloric acid makes the fiber brittle. Boiling 5 per cent caustic soda and dilute organic acids, on the contrary, have no effect; also the fiber is very stable to oxidizing and reducing agents. Nylon is more resistant to moisture than most fibers, and dries rapidly. It is not attacked by mildew and is moth-proof.

Regarding the dyeing of nylon, much information has already been published by its makers, so that a brief reference will be sufficient here. The fiber may be dyed successfully with selected acid, chrome and acetate dyes. The neutral dyeing wool dyes have been found particularly suitable, but for most purposes, and especially for dark shades, the acetate dyes are to be preferred, because of their good affinity for the fiber and ability to dye level. Blacks are usually dyed with the developed acetate dyes. Direct cotton dyes give various results on nylon; some dye it like cotton, while others leave it practically white. Those which do dye it are faster to washing than on cotton, and about equally fast to light. Vat dyes seem to have poor affinity for nylon, and the light fastness is not what it should be. Sulfur colors also have little affinity for the fiber.

Apparently the biggest opportunity for nylon at the moment is in the high grade hosiery field, where its elasticity and other good qualities make it a strong competitor of silk. In this connection, the manufacturer calls attention to the fact that in order to avoid the formation of creases and wrinkles during the dyeing, it is necessary to board the stockings and set the fibers by a treatment with steam before dyeing. This gives the hose a permanent shape, smooth and free from wrinkles, which is unaffected by later treatments, providing that the temperature does not exceed that of the steam treatment. Production of nylon hosiery has not yet reached a large volume, so that it is a little early to make comparisons with silk hosiery based on actual consumer reaction. Nylon has one definite advantage over silk in that the fibers are perfectly uniform from end to end, while silk fibers differ from one cocoon to the next and vary in diameter even in the same cocoon.

The possibilities of nylon in the clothing field have not yet been investigated sufficiently to be mentioned here, but there is no doubt that it will find many uses when a sufficient supply is available, and now would seem to be the time for the textile mills to get acquainted with it. The fiber itself, spun in various diameters, has already found employment in sewing thread (marketed under the name "Neophil,") fish-lines, surgical sutures, toothbrush bristles (called "Exton") and tennis racquet strings, to give only a partial list.

This paper would not be complete without a reference to a curious development of recent years, namely, the spinning of glass into extremely fine fibers, so flexible that they may be woven into textiles. "Fiberglas" as these fibers are called by their manufacturer, the Owens-Illinois Glass Company, has several interesting properties. It has a higher tensile strength than silk, is waterproof and fireproof and unaffected by practically all acids. On the other hand it is attacked by caustic soda, is damaged by abrasion and flexing, and cannot be dyed by any of the usual methods. Its use so far has been limited to electrical insulation, filter-cloths, table-cloths, bedspreads, fireproof awnings, etc., but it may have unexpected application in the future.

It is impossible in a paper of this size to mention every new fiber. Many of the foreign ones are little known on this side of the water, and besides, every issue of every textile journal brings a new crop, and if one tried to read all the journals, one would never have time to write a paper.

Now that chemists have learned how to synthesize from simple materials such as coal, water and air the long-chain molecules out of which textile fibers can be made, we may expect tremendous developments along this line, and it is safe to predict that other new fibers will soon appear. The invention of "Mauve" by Perkin in

1856 started a revolution in dye making. Perhaps the invention of nylon and Vinyon will start a similar revolution in fiber making. In this connection, may I quote from a recent editorial in the *Textile World*:

"We wonder if textile manufacturers realize what is going on. This is no mild development; this has the makings of an industrial revolution. And we are writing these words carefully, thoughtfully, without trying to be spectacular.

"The textile world has heard a lot about nylon this last year, and—more recently—about Vinyon, and other fibers which have threatened the position of silk in its last stronghold: full fashioned hosiery. But is that their main significance? For the moment, yes; but for the future, no.

"Their real significance lies in the fact that chemistry may now produce fibers out of almost anything: air, water, coal, gas, or what have you. And a corollary thought is that there are innumerable other sources: soybeans, corn, glass, et al. The main conclusion to be reached is this: Cellulose is no longer the sole source of synthetic fibers. In fact, there is a possibility that eventually it may not be the most important source.

"Think what that means to cotton agriculture! And to the synthetic industry, as we know it today!

"The man who, 50 years ago, might have dared to predict that eventually synthetic dyes would replace natural dyes would have been branded as crazy. And yet that has happened. Why? Because synthetic dyes are not subject to the whims of nature; they can be produced under the control of man, with almost 100 per cent uniformity. More important still, they can be modified at the will of the chemist to meet almost any need of the industry which uses it.

"And that is why, eventually, synthetic fibers will completely replace natural fibers.

"All we hope is that those textile manufacturers who are still mentally alive—and that means the majority, we believe—will take stock of their position and adjust themselves to a fast-changing textile world. If they do, they can profit by a participation in the new order. If they do not, others will take their places."

With this somber thought we will bring this paper to a close. The writer wishes to acknowledge the valuable information he has obtained from numerous journal articles and books, and in particular the papers presented at the Annual Conference of the Textile Institute in England last spring; also the historical articles which have appeared from time to time in the *Ciba Review;* from all of which he has borrowed liberally.

MEETING, SOUTH CENTRAL SECTION

THE winter meeting of the South Central Section was held on Saturday evening, March 9, 1940, at the Read House in Chattanooga, Tenn., with Chairman Fletcher L. Kibler presiding. Approximately seventy members and guests were present. The principal speaker was A. Kempton Haynes of Röhm & Haas Co., on "The Development of Resins for Hosiery Finishes." Lighter entertainment was provided by two motion pictures from "Field and Stream" entitled, "Ducks, Dogs and Decoys," and "Tarpon Acrobatics." The next meeting will be held in Knoxville at a date in May to be announced later.

Respectfully submitted,

FRANK F. MYERS, *Secretary.*

REPORT, NORTH CAROLINA STATE COLLEGE STUDENT CHAPTER

THE last week in March the North Carolina State College Chapter held its election of officers, which had been delayed by moving of the Textile School to its new building. Seymour Schandler succeeded W. L. Carter as Chairman, and William S. Pearson succeeded Mr. Schandler as Secretary. Professor Grimshaw gave a short talk on the purposes of the Association and the advantages of membership.

Respectfully submitted,

WILLIAM S. PEARSON, *Secretary.*

REPORT, LOWELL TEXTILE INSTITUTE STUDENT CHAPTER

THE Lowell Textile Student Chapter has held five meetings thus far during the school year and plans to hold several more.

On October 26, 1939, J. H. Hennessey of General Dyestuff Corp. spoke on the application of vat dyes. He stressed particularly the application of these dyes by the continuous process.

On November 16, 1939, Stephen K. Ford of Marden Wild Corp., Boston, addressed the members on the subject of sulfonated oils. He outlined the process of manufacture of these oils and told of their uses.

William B. Pollack of Fellowcrafters, Incorporated, Boston, addressed the members December 12, 1939. He discussed screen printing as a hobby and also its possible application to commercial printing.

On February 29, 1940, the Chapter sponsored a motion picture in the school hall. The motion picture was in color and dealt microscopically with the dyeing of fibers. The picture was presented by the Calco Chemical Company and was preceded by a discussion of the history of the dyestuff industry in the United States from 1913 to the present time by Arthur E. Sampson of Calco Chemical Company.

A business meeting was held on March 11, 1940. At this meeting a program committee was elected. George McTeague was elected chairman and Samuel Puliafico and Boleck Lizak were elected members. The chairman of the Section, Vernon Colby, spoke to the members on the subject of nylon.

Respectfully submitted,

NEIL MANNING, *Secretary.*

MEETING, NORTHERN NEW ENGLAND SECTION

A MEETING of the Northern New England Section was held at the Hotel Manger, Boston, Massachusetts, on Friday, March 8, 1940. There were fixty-six members present at the dinner and approximately seventy-five members attended the business meeting and technical program which followed.

Dr. E. E. Evans, Director, Medical Department, duPont Dye Works, gave an interesting paper on "Health Hazards of some Dyes and Chemicals," stressing particularly the diseases of the skin and interior irritations caused by dyes and chemicals. During the question and answer period which followed, Dr. Evans very graciously answered many of the members' questions as to how certain chemicals and solvents should be handled, without the usual number of attendant accidents and afflictions. At the conclusion, Dr. Evans was accorded a rising vote of thanks for the enlightenment of our section.

Also, on the same program, W. H. Seymour, Vice-President and Manager, Loss Prevention Department, Liberty Mutual Insurance Company, talked on, "Safety in the Textile Industry." This was an instructive address, emphasizing the training of the worker and mechanical safeguards to protect him from accidents.

Respectfully submitted,

J. N. DALTON, *Secretary.*

MEMBERSHIP APPLICATIONS

Senior

John Emmons Akers—Dyer and Chemist, Princeton Hosiery Mills, Princeton, Ky. Sponsors: W. J. Keily, Jr., A. J. Kelly.

Harry Leonard Blackwell—Dyer, W. B. Davis & Son, Inc., Fort Payne, Ala. Sponsors: H. Schroeder, F. F. Myers.

Stanley G. Ford—Supervisor, Azo Colors Area, E. I. duPont de Nemours & Co., Dye Works, Deepwater Point, N. J. Sponsors: E. F. Hitch, W. C. Brothers.

Leon Walter Gerst—Textile Chemist and Colorist, Hudson Dyestuffs Corp., New York, N. Y. Sponsors: H. L. Lobsenz, C. E. Moorhouse.

Andrew Mantz—Dyer, T. A. Harris & Co., Philadelphia, Pa. Sponsors: D. McGowan, R. W. Delaney.

Bruce O. Ranck—Chief Supervisor, Azo Colors Area, E. I. duPont de Nemours & Co., Dye Works, Deepwater Point, N. J. Sponsors: E. F. Hitch, W. C. Brothers.

George A. Rawcliffe—Asst. Supt. Swansea Print Works, Swansea, Mass. Sponsors: G. Garnett, S. I. Garnett.

Lawrence H. Roane—Dye Chemist, Erwin Cotton Mills, Cooleemee, N. C. Sponsors: R. D. Sloan, T. R. Johnson.

W. Norbert Berard—Chemist, Mount Hope Finishing Co., North Dighton, Mass. Sponsors: C. R. Ewing, W. S. Williams.

Junior

Robert F. Fritz—Laboratory Asst., T. A. Harris Co., Philadelphia, Pa. Sponsors: D. McGowan, R. W. Delaney.

Harvey G. Gendreau—Asst. Supt. of Bleaching and Finishing, Boott Mills, Lowell, Mass. Sponsors: W. W. Pennock, W. H. Zillessen.

Henry N. Schladt—Asst. Textile Colorist, National Aniline & Chemical Co., New York, N. Y. Sponsors: K. G. Morton, W. A. Holst, Jr.

UNEMPLOYMENT REGISTER

Members of this asscciation, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the American Dyestuff Reporter any vacancies which may occur in their business.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer; New York Viciniy. Age 33; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 37; married.

A-B-9

Education—Bradford Durfee Textile School, 1918, chemistry and dyeing course.

Experience—Dye application, textile and color chemist; good general factory, laboratory and office experience; accustomed to assuming responsibility; handled all types of help; purchased chemicals, dyes, etc.; executive ability; good personality.

Age 42; American, married; will go anywhere for interesting work; references.

A-B-10

Education—1 year of textile chemistry, day course, Philadelphia Textile School; also business course.

Experience—3 years as apprentice in weaving mill in Germany, office and stock room, general clerical work, practice in all departments of cotton manufacture, dyeing, bleaching and finishing of cotton-rayon mixtures, piece and package processing; several mos. in laboratory of German dyestuff manufacturer, dyestuffs and assistants and their application, vat and naphthol dyeing.

Age 20; will go anywhere in U. S.

A-B-11

Education: Graduate chemist. Correspond and converse German, some French.

Experience: 3 years dyer; 4 years dyestuff testing, trouble-shooting, purchasing; 4 years demonstrating, consulting, and supervising for large dyestuff manufacturer. Thoroughly experienced on rayon, cotton, silk, acetates, printing, vats. Fullest ref-

erences as to character and ability. Seeks position as technician, consultant, or superintendent with reliable dyestuff sales organization or dyehouse. Age 33, married.

A-B-12

Education—Philadelphia Textile School (Evening), Chemistry and Dyeing, Quantitative and Qualitative Analysis.

Experience—Two years in yarn office, making wool stock blends. Last 6 years in dyehouse, 4 years as kettle hand, 2 years in piece dye work. Worked on yarn, raw stock and piece goods; has been dyer on union piece goods, cotton, rayon and wool, leaving wool white; also worked on all wool fabrics and woolen cross dyes; also considerable laboratory experience doing laboratory dyeings and extraction work. Seeks position as dyer or laboratory technician.

Age 30; married; references.

A-B-13

Education—B.S., Chemical Engineering, Oregon State College, 1926.

Experience—First experience in dry cleaning plant; few months as sampling and control chemist with potash and chemical company; two years in dry cleaning plant, all phases of work; few months on routine and special analyses, plant problems, special studies and research for gas and electric company; 10 years teaching experience on textile chemistry, dyeing and textile testing covering all general and special courses in this field; consultant work with various mills. Seeks position in textile chemistry or dyeing.

Age 37; married; will go anywhere; references.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-8

Education—B.T.C., 1933, Lowell Textile Institute.

Experience—5 months as rayon slasher tender; 8 months color matching, dye testing and analytical work; 5 years with large print works in rayon finishing department, laboratory, color matching, dye testing, assistant rayon dyer. Seeks position as rayon dyer, assistant dyer, or any job in a rayon dyeing and finishing plant. Age 29; single.

A-B-C-9

Education—Lowell Textile Institute; chemistry, dyeing and textile finishing.

Experience—Twelve years head dyer in hosiery mills. Dyeing all types of fibers and in combination. Knowledge of all dye applications. Matching and formula making. Charge of every department in a hosiery mill except fixing machinery. Has done jigg work on cottons and rayons. Desires position in hosiery, or in any field. Would like to work as an assistant to head dyer in a woolen or rayon mill. Age 42; married. Will go anywhere in the United States.

A-B-C-D-1

Education—Lowell Textile Institute, Bachelor of Textile Chemistry; Lowell Textile Institute (Evenings), 2 years D. C. Electricity; 2 years A. C. Electricity.

Experience—Six years as chemist and assistant dyer with a large organization. Specialized in dyeing, finishing, bleaching and drying of woolens, worsteds, cottons, rayons and unions in the piece. Some sales experience. Desires position as chemist, dyer, finisher, bleacher or sales. Age 30; American citizen; Married.

A-B-C-E-1

Education—3 years Chemical Engineer major in college; honor graduate Philadelphia Textile School, chemistry and dyeing course.

Experience—Ten years experience as chemist, colorist, technical director in bleaching, dyeing and finishing of cottons and rayons. Also one year's similar experience in South America. Instructor of textiles and textile chemistry in state vocational school, 2 years. Married; age 32; references; will go anywhere.

A-B-C-F-1

Education—Textile Institute course in Dyeing and Chemistry; Extension work at Brown University; Executive Training with Alexander Hamilton Institute of New York, N. Y.; working knowledge of one foreign language.

Experience—Dyeing executive on all types of textiles including stock, yarns in the skein, warp and package, and piece goods. Thorough knowledge of all classes of dyes and dyestuffs and their successful practical application in the plant. Extensive knowledge of all types and makes of equipment for dyeing, bleaching, mercerizing and finishing. Laboratory practice in testing, standardizing, purchasing, costing, planning and checking processes, and market analysis. Good manager of personnel for better efficiency in retaining friendly labor relations. Conversant with modern methods for quality production economically secured through better coordination and correct alignment in processing, on cotton, viscose and acetate rayon, silk, wool, worsted, and mixtures. In excellent mental and physical health; excellent references.

A-B-D-1

Education—Special courses in general chemistry.

Experience—Twenty-nine years' experience in application and standardization laboratories of various dyestuff manufacturers. Well versed in the application of dyestuffs to different textile fibers, i.e., wool, cotton, rayon, silk, acetate rayon and unions, using direct, acid, diazo, sulfur, acetate rayon, chrome and after-treated direct dyestuffs. Six months' actual dye house experience on jigs, open boxes, padders, bleaching and mercerizing. Experience demonstrating sulfur and direct colors at various mills. Seeks position as textile colorist in application laboratory and demonstrator.

Age 46; single; references.

A-D-1

Education—Graduate of New Bedford Textile School, 1936.

Experience—Chemist for woolen mill 7 months; technician and salesman for chemical company 1 year and 9 months. Seeks position as salesman or in purchasing department.

Will go anywhere; married; references.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Graduate New Bedford Textile School; also post graduate work in advanced microscopy and rayon testing.

Experience—Five weeks in color shop of print works. Wants position in anything associated with textile chemistry, dyeing, finishing and testing.

Single; age 21; references.

B-D-1

Education—General education in England. Chemistry and Dyeing Courses at Huddersfield Technical School.

Experience—Has been a superintendent of dyeing since 1911. Has had experience in worsted mills, hosiery mills and woolen mills. Congenial, sober and reliable. Married; references; age 53.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.

Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.

43 years of age; single, in good health; will go anywhere.

LAPEL BUTTONS

These buttons, bearing the seal of the Association, can be purchased by members in good standing from the Secretary at $1.50 each.

Twentieth
ANNUAL MEETING AND CONVENTION
HOTEL COMMODORE
NEW YORK CITY
OCTOBER 18TH AND 19TH, 1940

General Chairman

PATRICK J. KENNEDY

SPORTS COMMITTEE

Nelson F. Mellin

Paul A. Dunkel

Harold W. Dingee

Auspices of

NEW YORK SECTION

MAX KAESCHE
Chairman, Sports Committee

THE sports committee for the twentieth annual meeting and convention will be headed by Max Kaesche of the Sandoz Chemical Works, Inc. Mr. Kaesche is eminently suited for this position as he is president of the Metropolitan Golf Association, is nationally known in golfing circles and has been champion of the Ridgewood Country Club at various times in the past. He will be able to arrange guest privileges for visiting members at practically any golf club in the metropolitan area. The members of his committee, whose names appear at the left, will be able to obtain tickets for football games or other sports attractions as desired.

Tubular Knit Goods

(Continued from page 183)

If the jersey is to be used for outerwear, some dyers prefer to use acetic and formic acids, while others sometimes use bisulfate of soda. Unless very level dyeing acid colors are used it is a good policy to stay away from sulfuric acid due to the light nature of the fabric and the susceptibility to wrinkles. The material is dyed according to regular methods preserving the above mentioned precautions.

In the dyeing of jersey for bathing suits, the dye bath is usually started neutral, in the case of milling colors, or very weakly acidified with acetic acid. Any additions to the dyebath must be made with care, due to the lightness of the fabric and its susceptibility to streaks. Cloth dyed in a neutral bath has a tendency to look "hungry or mousey," so that when care is used, a slightly acid bath is more desirable from a dyeing standpoint to improve the appearance of the finished fabric.

The cloth is then extracted in a regular vacuum extractor, dried on a tubular vertical knit goods dryer, and decated on a decatizing machine before wrapping and shipping.

Cotton tubular knit piece goods are employed for many diversified uses; for example, in the sportswear industry, large quantities are used in the polo-shirt trade and for trimmings. Cotton tubular knit goods are used in the rubber foot wear trade where the cotton is rubberized and processed.

The pieces first are usually boiled-off using combinations of soda ash, monopole oils, and pine oils to remove the waxes and foreign matter before dyeing. Here again, cleanliness prior to dyeing is of prime importance. Occasionally waxy formations due to the action of the soda ash and the waxes and lubricating oils used on the cotton form in the scouring bath and is a cause of annoyance and trouble in dyeing. The addition of solvents and lessening of the sudden chilling effect of the rinse water often is an aid in eliminating this source of trouble.

Where a semi-bleach bottom on the cotton piece is necessary for light shades, the addition of 1-1½ per cent of 100 volume hydrogen peroxide to the regular scouring formula gives a very good white base for light shades, where a full bleach isn't necessary.

The regular direct or developed colors are used for the cotton polo shirt trade depending upon the fastness requirements, whereas for the rubber lining trade, ordinary direct colors having no copper or manganese content are used.

In many cases, the direct colors are after-treated to increase the fastness to washing and water, and for this purpose, the regular methods as well as the newer so-called "fixing salts" are used. Care must be used with these fixing salts with respect to a final rinse as many of these salts are on the acid side, and if salts containing elements of a tri-valent nature are used, and the pieces are starched or sized, the sizing compound may have a tendency to break down and give no end of trouble. A last rinse then is a good precaution, for otherwise, some of the metallic ore of the after-treating bath may remain and cause damage to the needles of the sewing machines in the garment trade as has happened several times due to this cause.

After dyeing, the cotton pieces are centrifuged, dried and calendered if necessary, or dried, gummed and split as in the case of the rubber lining.

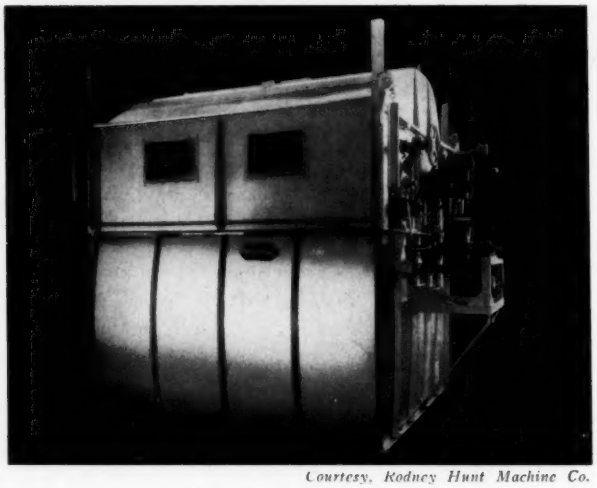
The drying of the cotton pieces should be done with care, as too high a temperature may cause heat streaks and so-called "crow-feet" due to the excessive heat on the tightly packed pile of cloth on the tubular dryer. A drying temperature of about 180° F. has been found to be ideal for this class of goods, although conditions may often vary.

Fabrics consisting of rabbit hair and wool often are used to obtain various effects, and some seasons find these particular types of cloth used extensively for the outerwear trade. Usually, this fabric is merely scoured with soap or monopole oil preparatory to dyeing as a considerable amount of flocking takes place due to the shortness of the fiber of the rabbit hair.

Ordinarily, the regular run of acid colors are used, but practical dyeing methods show that this fiber takes 25-35 per cent more color than the straight worsted fiber, and

Knit Goods Fulling Mill

Courtesy, James Hunter Machine Co.



Courtesy, Kodney Hunt Machine Co.

Knit Goods Dye Kettle

that the final shades are much duller and flatter in shade than one would ordinarily expect in dyeing this type of cloth.

Penetration is important here, otherwise the cloth looks drab and "mousey" in appearance due to the natural flatness of the fiber itself. It is a good idea to get the shade as quickly as possibly on this class of fabric due to the fact that prolonged working has a tendency to felt the goods and cause considerable "flocking off" in the dye bath.

After centrifuging and drying, the cloth usually is steamed and sometimes given a light brushing before rolling up and shipping.

It might be interesting at this point to include a little data with respect to the bleaching of this rabbit hair fabric as considerable difficulty has been experienced in the past with respect to the bleaching of this fiber, especially of the natural fawn colored fiber.

On a light greyish material, after the usual scour, bleaching for 18 hours at a temperature of 110° F. in a 2 volume hydrogen peroxide bath containing 4 pounds of sodium pyrophosphate per 100 gallons of bleach bath gave very good results without harshening the fabric to any great extent.

The dark fawn colored material usually gives a little more difficulty in bleaching, but a successful bleach can be obtained by bleaching the previously scoured material in a bath containing 4 lbs. of sodium pyrophosphate per 100 gallons with a 5 volume hydrogen peroxide at 110° F. for 42 hours. The addition of 2 pounds of sodium oxalate to the same bath even tends to give better results. Naturally, bleaching by this method implies sinking the pieces in the bleach tub.

After bleaching, the pieces are run out and given a slight acid treatment to neutralize the effects of the alkali, given a warm and then a cold rinse, centrifuged and then dried and processed in the usual way.

Acetate rayon deserves a little attention here as large quantities of tubular knitted pieces are consumed in the sports trade and garment cutting industries.

The scouring of these pieces is important, for here the fabric is really put in condition for dyeing and many defects are caused here. Depending upon the amount of lubricating oil used in the knitting of the cloth and type of oil used, the scouring bath is regulated accordingly.

Although there are many kinds of acetate rayon scouring compounds on the market, good results were obtained by scouring in a washer at 180° F. with 3 per cent of sulfonated castor oil and 1 per cent of an organic solvent such as xylol (based on the weight of the goods) along with sodium hexametaphosphate in the bath and run for ¾ of an hour.

By raising the rolls in the washer so that the nip wasn't too close, cracking of the fiber was prevented which would lead to defects in dyeing showing up as dark thin streaks, which in reality are not dye streaks. Some classes of goods have a tendency to crack and wrinkle here so that the utmost caution should be used in this procedure.

After scouring, the pieces are dyed in rope form in a regular piece-dye kettle with the regular line of acetate rayon colors at 180° F. The speed of the reel of the dye kettle should be about 32 R.P.M. for best dyeing results.

Care should be used in cooling off the cloth after dyeing as a sudden chilling of the fabrics sometimes leads to cracking and wrinkling of the cloth which cannot be removed in further processing. By having the water flow into the mixing box rather than having it hit the cloth directly, eliminates this source of trouble.

In extracting, the extractor should be brought up to speed and then shut off, as continued whizzing has a tendency to form non-removable crack marks and wrinkles.

In drying, too high a temperature should be avoided, 160-170° F. being ideal, otherwise a harshening may result. After drying, the cloth is rolled and shipped.

The outerwear industry consumes at times large quantities of so-called union fabrics, which often consist of cotton and wool, mohair and rayon, and any combination of each. The most difficult kinds to process, and especially dye, are the types where the individual class of fibers are knitted side by side, as cotton and mohair, or wool and rayon.

Often times, due to the construction of the cloth, the arrangement of the different fibers in the cloth results in a mottled finished appearance which no amount of chemical processing can overcome. In this case, it is a question of balance and structure rather than chemical processing.

Of late, combinations of spun rayon and worsted have been used extensively for the production of about an 8 ounce union dress goods fabric. Usually the pieces are scoured with soap or monopole oil in the washer without any fulling and thus prepared for dyeing.

As a rule, fast to light direct colors are used for the vegetable fiber and milling colors for the animal fiber. Best results in dyeing have been obtained by the gradual additions of common and Glauber's salt, half of the quantity being added at 140° F., and the remainder at the boil, so

as not to dye the spun rayon too heavily giving an unbalanced dye appearance. Direct cotton dyestuffs which do not have a tendency to boil over on to the animal fiber in processing seem to work the best in this type of dyeing.

Shades as a rule should be obtained as quickly as possible, as prolonged boiling has a tendency to felt the fabric and sometimes distort the pattern so that the original conception of the cloth is destroyed. If a dull lustered rayon is used in combination with the worsted, very little difficulty is experienced in dyeing, but sometimes dyeing proceeds with difficulty when a high lustered rayon is used, resulting in a fabric with an undesirable off-balance shine.

"Salting off" the colors after dyeing aids in setting the color and also helps to prevent "crawling" of the color, especially when the pieces are left lying around before drying. If the pieces are not salted off and are left lying around, so-called "crow-feet" or "lay-marks" may develop which necessitates re-handling of the goods and an economic loss.

Coating fabrics of 12-14 ounce weight are handled approximately the same way, the only difference being that after extracting and drying, the pieces are slit through the middle and opened full width preparatory to napping, brushing or steaming.

Often times, novelty effects are desirable, as in the case of the "cotton-backs," a fabric consisting of cotton and wool in which the cotton is dyed and the animal fiber left white or as near white as possible. Sometimes the animal fiber is varied so that mohair is many times employed to obtain a silky-hairy appearance.

The usual method of scouring is used, omitting any fulling operations unless required, but usually the percentage of animal fiber is so small, that fulling is a needless operation. The cloth thus prepared is run into a regular piece dye kettle and dyed with direct cotton colors that reserve wool white. Practical experience shows that a temperature not exceeding 140° F. is ideal in which some assistant is used to help prevent any staining of the animal fiber. The addition of 2-3 per cent of trisodium phosphate along with the requisite amount of common salt is a decided aid in preventing any staining of the animal fiber.

After dyeing, the pieces are salted off and sometimes after-treated to increase the fastness to water. If fixing salts are used as is sometimes done, care should be employed in application, as many of these salts set the color immediately upon using. These fixing salts as a rule are not used where the colors employed are not fast to acid, as many of these salts are on the acid side and have a tendency to throw the color off-shade when used in conjunction with that type of dyestuff.

After centrifuging and drying, the pieces are often steamed and brushed to emphasize the white fiber. In the case of coating materials, this type of fabric, if napping permits, results in a very desirable appearing cloth.

Finishing Treatments

Applied to Cotton Hose*

MARGARET S. FURRY and LILLIAN E. WEIDENHAMMER**

INTRODUCTION

IN connection with the cotton utilization program of the United States Department of Agriculture, the Bureau of Home Economics is investigating the possibility of increasing the use of cotton in women's hose. In addition to originating new hosiery designs suitable for various occasions and costumes, the Bureau also is interested in improving the properties of cotton hose and in developing in them new desirable properties that they do not possess naturally. The purpose of this study was to investigate to what extent improvements might be made in cotton hose by the application of various chemical finishes.

A specific hosiery property of great importance is its recoverable elasticity. A stocking with a high recoverable elasticity does not tend to become baggy in use. Cotton is not naturally so elastic as other textile fibers. Therefore, any finish that will assist cotton hose to regain shape after distension is a definite improvement. Another property that becomes of increasing importance with more sheer construction is the strength of the hose. In addition a requirement for a satisfactory finish is that it be permanent on laundering. For a fabric washed as frequently as hose a finish that withstands only a few launderings is of very little value.

In this study a number of different finishing treatments were applied to cotton hose and the hose laundered one, five, and ten times. The elastic properties, bursting strength, and weight of the hose were then measured.

LITERATURE REVIEW

A survey of the literature relating to fabric finishing indicates that very few studies have been made on special

*Appreciation is expressed to Herbert F. Schiefer of the National Bureau of Standards for cooperation in the interpretation of results obtained with the hosiery testing machine and to the management of E. I. duPont de Nemours & Company; Wolf & Company; Sandoz Chemical Works, Inc.; Scholler Brothers, Inc.; and Röhm & Haas Company for supplying finishing materials.

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finishing materials for cotton hosiery or on methods of determining the effectiveness of cotton hosiery finishing. There are a few reports concerned with the finishing and testing of silk hose.

Chwala[1] investigated the effect of octadecyloxymethylpyridinium chloride, a water-repellent finish, on rayons and various mixtures of cotton, rayon, and wool yarns. This finish reacts chemically with cellulose and wool and so affects other properties of these fibers as well as water repellency. For instance, since swelling capacity of the yarns is reduced, wet tensile strength should be increased. He discovered that the yarns treated with this chemical definitely absorbed less moisture than untreated ones, but an increase in wet strength was observed only in the yarn containing cotton.

Koons[2] discussed spotproof and water-repellent finishes on hosiery consisting of metallic soaps of zinc, aluminum, and copper combined with organic protective colloids such as waxes, gums, and glues. These finishes according to the author may change the color although there is less likelihood of change when the stockings are dried at room temperature. In the silk portion of the hose the color becomes more intense and in the cotton portion it is lighter. The author reported that actual wearing tests showed that silk hosiery treated with these repellent finishes were more snag-resistant, less likely to develop runners, and actually gave better and longer service than untreated stockings.

A letter circular issued by the National Bureau of Standards[3] contains directions for an aluminum-soap treatment for silk stockings. It is claimed that this treatment improves the distensibility and recoverability of some silk stockings and also makes them water-repellent.

Urea-formaldehyde and acrylate resins are in growing demand in the textile industry[4]. The urea-formaldehyde[5, 6, 7] process depends on the formation in the fabric of a urea-formaldehyde condensate. The effect is achieved by subsequently heating a fabric impregnated with a partially condensed urea-formaldehyde resin in the presence of a suitable catalyst. Widely different effects may be produced depending on which urea-formaldehyde resin is used and the conditions of its application. This type of finish is used to produce crease resistance in fabrics by improving their elasticity[8, 9]. Acrylate resins[10, 11, 12] include the polymers of acrylic and methacrylic acid and their esters. They are noted for their clarity, complete absence of color, and elasticity and toughness in the absence of plasticizers or softeners. Although they are not soluble in water they dissolve in many organic solvents. Also it is possible to polymerize them in aqueous emulsion. Different types of fabrics and paper may be coated or impregnated with these resins.

Schiefer and Cleveland[13] reported the effects of finishing, laundering, dyeing, ageing, and construction on the performance of silk stockings of various weights tested on the National Bureau of Standards hosiery-testing machine[14]. They found that different commercial finishes on similar stockings produced marked differences in result. A finishing treatment of aluminum sulfate and soap increased the "distensibility," "elasticity" and "endurability." Also the same laundering treatment did not have the same effect on all stockings and that the effect of laundering depended largely on the kind of finishing treatment the stockings received. Both dyeing and ageing decreased the distensibility, elasticity, and endurability of degummed stockings; ageing had the same effect on dyed stockings. They also found that increase in size of yarn of which the stockings were knit was accompanied by a decrease in distensibility.

SELECTION AND PREPARATION OF MATERIALS

These studies reported here were made on full-fashioned cotton hose, some of which were hose bought on the market and the others were especially designed by the Bureau. The latter hose were knit to specification from high quality commercial combed yarns of regular twist. Also, some of the hose were made with a plain top, the others with a stretch top to give greater distensibility above the knee. All were plain knit, from yarns of different sizes, and dyed to approximately the same color and shade. These hose are designated on the basis of yarn size and finish (Table 1).*

The hose bought on the market, designated by letters A and B, were knit from yarns of yarn number 120/2 and 140/2. The letters C, D, E, F, and G designate the especially designed hose made from 60/2, 70/2, 80/2, 90/2, and 100/2 yarns respectively. Hose A, C, D, and E had plain tops and hose B, CY, CX, F and G had stretch tops. Hose CY are similar to C except for welt construction. For purpose of comparison one lot of hose, CX, from 60/2 yarns, had spun viscose plied with the cotton. The subscripts used with the letter designations refer to the numbers assigned to the finishes with which the hose were treated.

Ten different finishing treatments were applied to the hose. Usually five hose were processed at a time and all finishing baths were made up to the volume of 1 liter, thus allowing 200 ml. for every stocking. Before the hose were immersed in the finishing bath, they were wet thoroughly in distilled water and the excess removed by squeezing through a wringer adjusted each time to approximately the same tension.

Finish 1 is an oxy-quaternary compound, called octadecyloxymethylpyridinium chloride. This compound reacts chemically with cellulose to form a water-repellent cellulose ether. The hose wet out with distilled water were immersed for a few seconds in an aqueous solution maintained at 32° to 43° C. of 15 per cent of the finishing compound and 5 per cent sodium acetate, based on the dry weight of the hose. After immersion in the mixture for 3 minutes, the hose were quickly squeezed through the wringer, dried in front of a fan, and then baked for 5 minutes in an oven at 120° C. Next they were washed and neutralized by treating in a solution containing 0.05

*Will appear in next issue.

per cent of sodium lauryl sulfate by weight and 0.1 per cent soda ash at about 50° C. and then rinsed thoroughly in distilled water, also at 50° C. They were dried at room temperature.

Finishes 2, 3, 4, and 5 are of the class of water-repelling agents that deposit waxy materials on the fibers. These finishing agents are emulsions of wax and either aluminum acetate or formate. Finish 2 was applied to the hose by immersing them for 3 minutes at 80° C. in an aqueous solution containing 4 per cent of the emulsion, based on the weight of the hose. In applying finishes 3 and 4 the hose were immersed for 10 minutes in a solution made up of 3 grams of wax emulsion and 100 grams of water, and maintained at 38° C. Finish 5 was applied in a textile finishing plant according to mill methods. The hose were immersed for 15 minutes in a bath kept at about 50° C. and containing 5 per cent by weight of the wax emulsion, 2 per cent of formaldehyde, and 2 per cent of a finishing oil. The hose after immresion in the finishing bath were extracted without rinsing and dried on hosiery inspection forms made according to measurements recommended by Schenke and Shearer[15]. All of these hose were dried at room temperature except those treated with finish 2 which were dried on heated forms.

Finishes 6, 7, and 8, are insoluble soaps of chromium, aluminum, and cadmium, respectively. In applying these finishes, the hose were agitated in a 0.5 per cent neutral soap bath for one-half hour at 70° C. Then they were squeezed through the wringer and quickly immersed and worked for 10 minutes at 38° C. in a solution containing 1 gram of the metallic salt for each 100 ml. of water. The hose were again squeezed through the wringer without rinsing, and dried on hosiery forms at room temperature. For finish 6 chrome alum was used; for finish 7, potash alum; and for finish 8, cadmium chloride.

Finishes 9 and 10 are synthetic resins. Finish 9 is urea-formaldehyde resin, such as is commonly used to make fabrics crease-resistant. A finish of this type was included in this study since increased crease-resistance means increased elasticity. It is true that cotton fabrics treated with these urea-formaldehyde finishes have not quite the tensile strength of a similar unfinished fabric. However, this loss in strength is usually not great and combed cotton yarns maintain their strength better than carded yarns[8]. The cotton hose in this study were made from combed yarns.

The hose to be treated were immersed in a solution containing 7.5 per cent resin, 0.5 per cent gelatin, 2.5 per cent of a softening agent, and 0.3 per cent of an acid catalyst, based on the dry weight of the goods. The hose were agitated in the mixture at 32° C. for 10 minutes, then after squeezing through the wringer, they were boarded. When dry they were finally baked in an oven at 130° C. for about 10 minutes.

Finish 10 is a methyl acrylate resin emulsion. In applying this finish the hose were immersed for one-half hour in a solution containing 2.5 grams of resin to 100 ml. of water, made slightly alkaline with ammonium hydroxide. Then, after the excess resin emulsion was squeezed out, the hose were dried without rinsing on hosiery forms at room temperature.

All hose, before finishing treatments were applied and also before they were tested, were carefully washed in a Launder-Ometer. In this procedure the stocking was placed in a one-pint jar containing 200 ml. of 0.5 per cent neutral soap solution at 38° C. The jar was agitated for 30 minutes after which the stocking was removed and rinsed in four changes of water at the same temperature. The excess water was removed by squeezing through a wringer. This method is similar to that given by Schiefer and Cleveland[13], the only difference being that they used a centrifuge for removing excess water instead of a wringer. Although this method is for silk fabrics, it was employed here since it is less severe than the standard method for washing cottons. This is justified since a previous study[16] showed that specially treated fabrics must be laundered carefully in order to preserve their finish.

In order to determine the effectiveness of these finishes after repeated launderings, some hose were washed four times more, making a total of five, and other hose were laundered to a total of ten times. Then they were boarded on hosiery forms.

(To be concluded in next issue)

Tub Dyeing and Package Dyeing

(Continued from page 184)

it I pointed out the saving in labor I could effect by dyeing the bigger lots by machine. His answer was that they had bought one of 100 pounds capacity the year before and the dyer could do nothing with it. All the dyeing came out uneven and they had sold the machine at a big loss. I found out later that this dyer did not want that machine at all.

In a mill where they use only 200 pounds of silk yarn a week they installed one of the most modern dyeing machines, where they dye the small lots they need in several shades and they are doing it successfully. In another mill where 25 to 30 men are steadily employed dyeing about 1,000 pounds of narrow ribbons, silk and rayon yarn every day, I mentioned to the production manager that I could reduce his payroll considerably if he would put in a few dyeing machines, which would pay for themselves in a short time. This is what he said: "When they put on the market machines which will pay for themselves in one year I shall buy them. Now they cost too much." That was in 1932 and labor was getting cheaper. The short hours and high cost of labor prevailing today may have made that man change his mind. However, it is easy to see that the benefit of skein dyeing by machine is still a matter of opinion, and not thoroughly understood.

ADVANTAGES OF BEAM DYEING

Package and beam dyeing on the other hand is steadily increasing in popularity for those yarns which may be suitably dyed by this type of apparatus. Constant improvement in the last few years has made it possible to use this apparatus for most dyestuffs of any degree of fastness.

Direct, developed and vat colors and most of the naphthols can be used with good results. However a careful selection of these dyes is imperative. Dyes which are not easily dissolved, or are readily thrown out of solution must be avoided. They may be perfectly suited for dyeing by other methods, but when used for dyeing under pressure there is always the danger present of some undissolved particles being screened out, the packed yarn serving as a sieve to retain them, and staining the threads with disastrous results.

The main purpose of dyeing on beams is to economize on the cost of processing and to reduce the waste inherent to winding and warping dyed yarn. Cotton yarn both single and two-ply, from 10's to 40's can be easily dyed by this method with consistently good results, provided the proper tension is maintained in winding the yarn on the beam. There are other yarns which may possibly be dyed successfully on beams. Spun rayon has been attempted and there is no doubt it will be dyed if good penetration can be obtained by winding the yarn on the beam with the proper tension.

At the conclusion of dyeing the yarn is usually dried on the beam and then removed. It can also be run wet, or partially wet on the slasher, in which case the drying is completed during the slashing operation, delivering the warps properly sized, ready to put on the loom.

PACKAGE DYEING

Package dyeing is taking the place of skein dyeing to a large extent today, more so than beam dyeing, because a larger variety of fibers can be dyed successfully by the former method. Beam dyeing is done exclusively on warps; yarn dyed in packages can be used for warps, filling, knitting and for many other manufacturing purposes. Many yarns which presented difficulties in dyeing by the older method of turning by hand over sticks, can be dyed easily when wound on covered springs and packed in the kier. Silk noil yarn, which is the yarn spun from what is left after the third, and sometimes after the fourth draft is taken out of the silk waste in spun silk manufacturing, is one of them. Yarn made out of roving, the intervening process between carding and spinning in which the slivers are separated from the combed laps of cotton and other fibers are reduced elongated and slightly twisted for spinning, could not possibly be dyed by hand or on any machine without a lot of waste. In package dyeing there are no breakages and this yarn can be dyed successfully for any purpose by the package method.

The dyestuffs used for package dyeing have to b selected with care, the same as for beam dyeing, in regar to solubility and penetration, the process being essentiall the same. Most kiers used for package dyeing can also b used for dyeing on beam. The same pump can be adapte for both, except that a higher pressure is necessary t force the dye through a beam full of yarn.

The only objection I have ever heard against packag dyed yarn has been that the yarn was not as soft as skei dyed yarn. I was talking to a hosiery knitter about it an he told me that whenever he bought dyed knitting yarn h always specified that "he wanted skein dyed yarn." H was under the impression that it was the pressure used i dyeing package yarn that caused an undesirable harshnes and could not be dyed as soft as the yarn dyed in skeins When I reported this to a package dyer I was told th same softness could be obtained by both methods when th proper softener was used. My opinion is that the hig temperature used in drying the yarn in the package cause the harsh feel my knitter friend complained about.

The reason for my contention is that the raw stock which is also dyed in kiers under pressure, can be finishe as soft as desired. This dyed stock must be soft enoug so it can be worked easily in the following operation o combing, drawing and spinning, and this is obtained b drying it in a suitable dryer in which the temperature of th drying chamber can be regulated to preserve the softnes necessary for milling the stock. So it is quite obviou that, provided the proper finishing materials are used, an the drying is not done with undue haste, package dyed yar can be made as soft as the skein dyed.

THE DYEING OF THE FUTURE

Judging by the progress and changes that has take place in dyeing processes and dyeing machinery in the las half a century much more will be achieved in the next fe years; but in my opinion there will be skein dyeing bot by hand and by machinery for some time yet. Dyeing ma chines have found their place as undisputably as hav package and beam dyeing machines. Their existence i well established in the textile industry, but no one styl of operation will ever supersede the other and supplant altogether, not even the old fashioned, reliable hand dyein of my younger days. At least we will not live to see i

The many new synthetic fibers which are brought int the industry, each with its own peculiarities, dye problem and difficulties will call for new and different modes o processing. There may come a time when all existin dyeing methods and machines may have to be scrapped lik the model T Ford and our mode of processing become matter of history like those of our granddaddies, who ha to extract their own dyes from wood, flowers, roots an bugs, but the new, younger generation of dyers need hav no fear on that score. They will have the same opportunit of learning the new ways that we old timers have had.

Finishing Rayon Hose*

The Physical Properties of Rayon in Relation to Hose Finishing

A CHARACTERISTIC of modern ladies' rayon hose is that they have a very short life. On this account the appearance of the hose is of much more importance than fastness of color, and the dyer and finisher is therefore primarily concerned with giving them an attractive appearance.

For many years after the introduction of rayon hose little attention was given to the fact that rayon has properties which are quite different from those of cotton and other fibers, and it is only during the past ten years or so that attention has been given to methods of finishing more suitable for viscose rayon.

The older and most common method of finishing hose consists of stretching each stocking in the damp state over a wood or metal shape, and then pressing between steam-heated plates. The two- or three-bed press was almost universally employed for the pressing operation, the pressure between the hot beds being obtained direct or by springs, and the necessary high temperature, 110° to 115° C., by steam supplied to the hollow beds. Under these conditions each stocking is fixed to shape by rapid drying while in contact with hot metal plates.

Another method of finishing, but one which has only made very limited headway among hose finishers, is that which uses internally steam-heated shapes. Such shapes are usually fixed vertically and when the stocking is drawn over a shape it is left on it until dry—no pressing is involved. The object of this finishing method is that of avoiding the calendering action of the hot press.

The former and most commonly used method of finishing does not take into account certain prominent properties of viscose rayon. Whenever a textile material is dried by pressure between hot metal plates it acquires increased luster and generally becomes firm in handle. The hot press is thus not unfavorable to the finishing of cotton hose since in general this benefits by increased luster. But nowadays very little cotton hose is worn. It is now fashionable to wear rayon hose having a subdued luster even less than that of silk.

It is one of the peculiar properties of viscose rayon that it is considerably more susceptible to the influence of mechanical forces than is cotton. Rayon hose can thus receive a marked increase of luster and firmness in the pressing operation and to this extent the steam bed press is unsuitable. The reason for the luster increase is that in the pressing the surface portions of the rayon threads are flattened and a smoother surface is more lustrous than one which is rough. The wetter the rayon is at the time that it is subjected to heat and pressure the more permanent is the flattening, and under similar conditions of treatment viscose rayon takes a more permanent degree of flattening than does cotton. It is necessary that the rayon hose be damp during the finishing operation and thus there is little chance of avoiding the production of luster. If the dampness is excessive or the temperature and degree of pressing somewhat high then the hose acquires a glazed appearance.

One method of minimizing the amount of flattening of the rayon is to cover the metal surface of the press with fabric; to some extent the uneven surface of this fabric becomes imprinted on the hose and the luster can be reduced in this way. But most hose finishers do not like this expedient since it involves an added cost for fabric which must be renewed from time to time and also because it reduces the rate of heat transference from the metal to the hose and so reduces the output from each machine.

The firmness of handle introduced into the hose during finishing in the press is due to the "set" which always takes place when a textile material is dried under tension, in this case simultaneous pressure is not necessary. The same thing is noticed when cotton and rayon woven fabrics are hot air stentered from a wet condition. However, viscose rayon is very liable to take this "set" and the hose taken straight from the press are usually found to be quite stiff. But there is an easy corrective. If the hose are given a slight pull lengthwise by the operative as they are taken off the shapes the resulting temporary distortion breaks up the "set" and the firmness almost completely disappears.

In order to avoid the disadvantages of the ordinary press many finishing machines of a different construction are now in use. The principle underlying such machines is that each stocking is dried by hot air while free and not in compression contact with any hot metal surface. At least three types of such machines are being used. In general, the hose are first drawn over the metal shapes which are then exposed to a spray of water or at least a very damp atmosphere; it is necessary to damp or wet the hose much more than in ordinary press finishing. Afterwards the shapes are led through smoothing rollers (these must be fairly soft) and then through a hot air chamber so that the hose dry on the shapes. Often the

*Textile Mercury and Argus.

machine is provided with a final cooling and conditioning chamber so that the hose have a good handle when drawn off the shapes.

There are new factors in these new methods of finishing which depend on the special properties of viscose rayon, and generally it is found that the appearance of the finished hose is better than that of hose finished in the older steam bed press. There is no flattening of the surface of the hose as the outside surface does not come into contact with anything except hot air during the drying. The luster of the finished hose is thus the lowest possible. But although this is an important point it is much less significant that the appearance of the hose is much more even and attractive.

If the stocking in its damp condition immediately before finishing is examined it will generally be noticed that it has a "liney" appearance along the length of the panel, i.e., the leg portion. These lines are due to wales of stitches knitted somewhat more closely together than in the remainder of the panel. If the damp stocking is stretched over a shape and pressed in the usual press the lines can be seen in the finished stocking. If the stocking while stretched over a shape, is thoroughly wetted and then passed between soft rollers so that the stocking is rolled, stretching in length takes place as a direct result of this treatment, and if it is afterwards dried in hot air most of the lines are removed. It is remarkable how such a treatment can make a "liney" stocking ultimately appear quite even in texture.

It is believed that this improvement is due to the high extensibility of viscose rayon threads and their power to contract to normal length during drying after wetting. When the stocking on the shape is thoroughly wet the viscose thread is uniform as regards its reaction to stretching forces and is furthermore more easily stretched than when dry or slightly damp. It is thus likely that as the wet stocking passes between the rollers the thread stretches considerably to allow length stretching of the stocking as a whole; at the same time the combined effect of rolling the knitted structure (so freely extensible) is that of smoothing out the irregular stitches. Then in the drying, the rayon thread contracts evenly leaving the stocking with a uniform appearance.

In the older press method it is not practicable to wet the hose for the reason that too great a glazed luster would be produced. Neither is it possible to introduce the rolling operation. Finally, it will be evident that there would be no possibility for the rayon thread to contract in the drying. This latter point is emphasized by the fact that a pressed stocking is always longer than one finished by the newer methods using hot air. Non-maintenance of stocking length has been a difficulty for hose manufacturers who are not too eager to knit the hose longer to allow for shortening of length.

As some confirmation of the above explanation it can be noted that the improvement of appearance is more definite with hose of good quality where the stitches are closer. Also, no such improvement of appearance is observed with cotton hose where the threads have not the same property of easy and considerable extension under stretching forces. The new finishing methods can thus claim to be making full use of the possibilities allowed by the special properties of viscose rayon.

• BOOK REVIEWS •

The Chemists' Year Book. *F. W. Atack, M.Sc. Tech., D.Sc., B.Sc. Chemical Publishing Co., of New York, Inc., New York.* 1257 *pages. Price* $6.00.

The Chemists' Year Book, founded by F. W. Atack was among the first of a number of similar year books which have been published, many of which have been to a considerable extent copied after this particular book.

In the present edition, the values of Atomic Weights have been brought up-to-date and the sections dealing with the General Properties of Inorganic and Organic Compounds have been improved; also the section on Crystallography has been redrafted by Dr. M. H. Hey of the British Museum of Natural History, with a view of making it more useful to the general chemist. One part of this section is intended for the general chemist, while the other part is a collection of formulae and data more particularly for the crystallographer. In addition, progress in alkaloid chemistry has been noted in the section on alkaloids.

Of particular interest to textile chemists and colorists is the section, pages 1035 to 1092, which is devoted to dyestuff intermediates and the coal-tar dyes, structural formulae of many different dyes being given. This also includes a section entitled "Identification of Dyestuffs in Substance and on the Fiber."

Boiler Feed Water Treatments. *F. J. Matthews B.Sc. Second Edition Enlarged and Revised. Chemical Publishing Company, New York City,* 1940. 319 *pages* 31 *diagrams and tables and* 21 *halftone illustrations. Price* $5.00.

Few plants are sufficiently fortunate as to have a boiler water supply, that requires little if any attention. For the most part, the reverse is the case, and boiler water becomes not only one of the serious but also one of the expensive problems of the mill. In its present edition, this book is one of the most complete and up-to-date upon the subject. Great changes in boiler design in the past few years, and the study of scientific methods of correcting water both by purification and chemical treatment, make it almost imperative for the plant engineer to become well posted upon this subject. This book may well be recommended to them for this purpose.

TRADE NOTES • NEW PRODUCTS

• LABORATORY MIXER

The Mixing Equipment Co., 1062 Garson Ave., Rochester, N. Y., has announced the new model "F" laboratory mixer. Advantages claimed are: portability and ease of handling, adjustable speed friction drive, may be used on beakers as small as 300 cc. without spilling contents, may be used for inflammable materials since motor is totally enclosed, useful over a wide range of viscosities. It is available in 110 or 220 volt, 60 cycle, one phase current. Literature is available upon request.

• SUMMER COURSE

The department of chemical engineering, Massachusetts Institute of Technology, Cambridge, Mass., announces the fifth special summer program in "Theoretical and Applied Chemistry and Physics of Matter in the Colloidal State." The course will last for five weeks, beginning June 17th, and will be under the direction of Dr. E. A. Hauser. The program will consist of lectures, round-table discussions, and practical training in laboratory and research work, and is offered to men actively engaged in industry or research and to graduate students. Applications and correspondence concerning the course should be sent to Dr. E. A. Hauser, M. I. T., Room 2-013, Cambridge, Mass.

• CIBA REVIEW

Ciba Review, for March, 1940, has recently been distributed. Featured in this issue is the subject of "Textile Printing in 18th Century France." Contents are described by the following titles: The Controversy over Indian Prints, The Great Textile Printing Factories in France, The Technique of French Textile Printing, The Patterns of the "Toiles de Jouy," Historical Gleanings. There are many interesting illustrations concerning the subject matter.

• SAN FRANCISCO OFFICE OF CIBA

Ciba Company, Inc., has announced that, effective April 1st, the new address of the San Francisco office became 231 Sixth Street, San Francisco, California. The new telephone number is GArfield 3730.

• HATCH TEXTILE RESEARCH, INC.

Sixty years of continuous professional service to the textile industry of New York City by members of the Hatch family are being celebrated this year and in commemoration thereof Hatch Textile Research, Inc., have adopted a new seal of certification such as is shown. Herbert Harriman Hatch, president of the corporation, will mark his 14th year in the testing laboratory profession on May 1st.

Mr. Hatch's late father established himself in 1880 at Canal St. near Broadway, which was then the local textile center of the city. He was engaged in grading and reconditioning woolens and cottons for textile mills and acted as their representative in matters of dispute. About 1890 he became a public textile adjuster representing at various times such concerns as S. Slater & Sons, William Whitman & Co., J. P. Stevens & Co., Botany Worsted Mills, Parker, Wilder & Co., and A. D. Juilliard & Co.

Mr. Hatch was in the textile adjusting business with his father and later under his own name for many years prior to the opening of the laboratory in 1926, during which time he gained much knowledge of the trade and its requirements. Today the laboratory serves many and varied interests in the textile and related fields including John Wanamaker, Best & Co., Franklin Simon's, Bonwit Teller, Inc., Bloomingdale's, The City of New York, International Silk Guild, Inc., American Enka Corp., Melville Shoe Corp., Cohn-Hall-Marx Co., Inc. and others.

• SORBTEX PROCESS

A folder describing the Sorbtex Process for increasing the absorbency of cellulose fabrics has recently been issued by the Sorbtex Foundation, 210 East Franklin St., Richmond, Va.

This recently perfected process is the result of nine years of research on the part of two southern textile chemists, Dr. Warren L. Moody and Dr. Stanley J. Wagar, of Richmond, Virginia.

It is stated that, in addition to increasing the absorbency of cotton and linen textiles, the Sorbtex process increases by about 10 per cent the tensile strength of the yarns and makes the finished products immediately available for use, without the necessity of "breaking in." Applied immediately preceding Sanforizing, it is claimed that the use of Sorbtex assures that every fiber will be thoroughly wet, eliminating the possibility of extra shrinkage when the finished article is returned to the consumer from its first trip to the laundry.

• JOINS QUAKER

Quaker Chemical Products Corp., Conshohocken, Pa., announce the association with them of Daniel E. Finkel, who will represent them in the textile industry in the Metropolitan, New York and New Jersey area in the capacity of Technical Sales and service.

A major portion of his work is connected with the group of Diapene Synthetic Resins the Quaker Chemical Products Corp. has recently developed for the textile field.

Mr. Finkel is a graduate of New York University taking his degree of Bachelor of Science in Chemistry. He was previously plant and development chemist for Armour & Co. at their North Bergen soap works and until recently was associated with Olive Oil Soap Co. of Paterson in their Technical Sales Department.

• CHEMICAL EXPORTS

Foreign demand for American chemical products continued active in February of this year when exports of such products were valued at $19,436,000 compared with $20,432,000 in January and $11,958,000 in February, 1939, according to C. C. Concannon, Chief, Chemical Division, Department of Commerce.

Practically every item entering into the chemical export trade shared in the gains recorded in February and other recent months and every country and trading area of the world is now buying more American chemicals and related products, Mr. Concannon said.

Analysis shows that during the six-month period following the outbreak of hostilities in Europe—September 1939 to February 1940, inclusive—foreign countries purchased $127,000,000 worth of American chemical products, a 60 per cent increase over the $79,600,000 worth of similar materials sold abroad during the corresponding months of 1938-39.

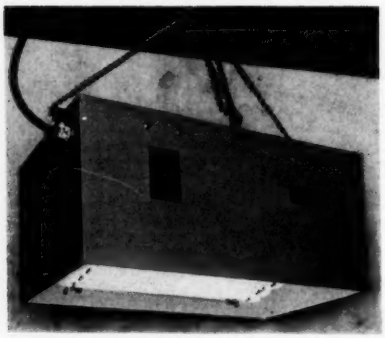
While increases in February were general throughout the chemical export list, outstanding gains were recorded in shipments of industrial chemicals, coal-tar products, medicinal preparations, naval stores, and paint products.

The gain in exports of coal-tar products has been due mainly to the widespread demand for American dyestuffs. Exports of all types of coal-tar products were valued at $2,420,600 in February, compared with $876,500 in the corresponding month of 1939. Shipments of dyestuffs during these periods increased in quantity from 752,000 to 2,583,700 pounds and in value from $387,000 to $1,116,400. Exports of benzol, also included in the coal-tar group, increased in quantity from

1,351,800 to 2,510,700 gallons and in value from $196,400 to $474,000, according to preliminary statistics.

• ANALYTE

Analyte, a white light developed for the purpose of properly matching colors of all types of material and products under conditions requiring north sky light, is announced by Color Analysts, Inc., 610 Bloomfield Ave., Bloomfield, New Jersey, manufacturers. This new unit has applications in the textile, plastics, cosmetic,



Model K201-B Analyte

paint, fur, paper, jewelry, dental, printing and other industries.

It is a luminous daylight color matching lamp designed and manufactured to produce a soft, diffused but penetrating white light for practical application on all types of materials and products. This source of light is said to be consistent twenty-four hours a day, regardless of season and location.

It is stated that the true and unvarying banded spectrum has the spectral balance of north horizon skylight, thus containing the necessary proportion of blue as well as red so vitally needed for accurate color matching. The light is produced by gaseous discharge tubing, and being white at its source, no corrective filters or fluorescent coatings are required.

The clear glass tubing used in Analyte is bent in the form of a grid covering the entire area of the reflector surface. This grid is held in place by spring clips and is easily removed and replaced. The white porcelain reflector is easily cleaned by simply wiping with a damp cloth. Normal line voltage variations and temperature changes will not affect the quality of the spectrum during the useful life of the tubes, it is said.

Mazda lumiline lamps are installed in the reflector and may be alternated with the daylight for comparative matching under artificial illumination. Analyte is air cooled and insulated to insure cool operation under steady and continuous operating conditions. The outside coating is a neutral grey baked wrinkle finish.

This light, manufactured under U. S. Patent No. 2,139,732, is the culmination of research started 10 years ago. It is stated that it has been tested under practical conditions in the textile industry for several years.

• JOINS PHOENIX

Phoenix Color & Chemical Co., Inc., announces that Harold W. Rose has become a member of the firm in the capacity of vice president in charge of sales. Mr. Rose was formerly employed as sales manager of the Warwick Chemical Co. It is expected that a sales expansion program will be launched in the near future to cover all the leading centers of the industry.

• CHEMICAL EXPOSITION

Chemistry and chemical industry will feature the American Chemical Exposition by the Chicago Section of the American Chemical Society announced by R. C. Newton, of Swift & Company, chairman of the committee in charge, at the meeting of the Chicago Section at the Stevens Hotel, Chicago, on March 29.

Plans for the first Exposition, to be held December 11 to 15, 1940, at the Stevens Hotel, have been perfected by a committee of ten and approved by the Board of Directors of the Chicago Section. Funds for promoting that Exposition have been supplied by the Section.

Emphasis will be placed on chemical products, Dr. Newton said, and scientific exhibits will be included. The plan is to make this the first of a series of expositions to be held in even numbered years to alternate with the Exposition of Chemical Industries.

"Approximately 32,000 square feet will be available for exhibits," said Dr. Newton. "We expect to provide and assign booths to some 300 exhibitors. The exposition has the indorsement of Dr. S. C. Lind, president of the American Chemical Society, and C. R. Wagner, chairman of the Chicago Section.

"The show is designed to depict the science of chemistry in many of its phases and its application to industry and the needs of man. Chemistry plays a part in providing to civilization the luxuries as well as the necessities of life. It has also done its share in providing work for the unemployed through the medium of new developments and new applications which it has opened by new discoveries necessitating the building of new plants or the occupancy of idle factories during the economic depression. We anticipate that Chicago will become the capital of the world of chemistry during the exposition."

Employed by the committee as Exposition manager is M. W. Hinson, a man of long experience in the field. Offices of the Exposition have been opened by the committee at 110 North Franklin St., Chicago, Illinois.

• DU PONT BROADCAST

The history of the American dyestuffs industry and its rise to a place of world prominence was described in the commercial part of the Cavalcade of America radio program sponsored by the Du Pont Company in the weekly coast-to-coast broadcast Tuesday, April 2. This program was heard by approximately 6,000,000 listeners and was the medium through which they were told the status of what has become one of the most important key industries in the United States. The broadcast told of the arrival of the German submarine which crossed the Atlantic during the first World War bringing a cargo of dyes to the United States and thus helping in a small way the textile and other dye using trades to meet their requirements. The national emergency brought on by the cutting off of regular supplies of dyes inspired Du Pont as well as other chemical companies in this country to set out to build a new American dye industry from the ground up. For five years, the commentator related, this costly enterprise was operated at a loss, and more than once the job was nearly abandoned. The broadcast pointed out the success of the program as evidenced by the fact that today the Du Pont Company—although one of 40 American makers of dyestuffs—produces 1,200 dyes used in almost all branches of the textile industry. In addition, it was said, this research has created new fast dyes that are equal to or better than those produced in any foreign country.

The commercial discussion also called attention to the work of young William Perkin who discovered the first dye from coal tar, and how that was the beginning of dyes made by chemistry, — a development that has completely revolutionized all dyes consuming industries. Reference was also made to the fact that in honor of William Perkin, who was later knighted, the American Section of the Society of Chemical Industry now makes an annual award for outstanding services in applied chemistry called the Perkin Medal. Dr. Charles M. A. Stine, vice-president of the Du Pont Company, was the man elected to receive this medal for 1940.

• WOOL TESTING LABORATORY

The Bureau of Customs' new wool-testing laboratory at Boston was inspected on March 25th by Commissioner of Customs Basil Harris. Representatives of the wool industry, importers, dealers and manufacturers were invited to view the laboratory at the same time and have its operations explained to them. The laboratory is in the Appraisers Stores Building, 408 Atlantic Avenue.

Elimination of guesswork is the purpose of the laboratory. The new plant is the result of two and half years' research and experimentation by Treasury Department scientists. The laboratory's work is based on a new system of sampling wool. A sampling device is employed to take small portions from any part of a bale. The samples, given laboratory treatment, show the average "clean content" of any lot of wool.

The sampling device involves the use of a steel tube with razor blades. The tube penetrates a bale, cutting a sample from any desired portion. This operation takes four to eight seconds. As many as 110 bales have been sampled in 70 minutes. The new laboratory and sampler replace time-honored methods of testing wool for clean content. Under the old method, a good deal depends on the opinion of the expert who judges the samples.

It was necessary to design and construct special testing equipment for the laboratory. A machine, the first of its kind ever to be employed in this manner, was developed. This machine employs a dry-cleaning solvent which removes the bulk of the impurities in the wool sample. The sample is then dried, and the solvents recovered and refined. The dried sample is dusted and again made cleaner and more uniform. Portions of this sample are then scoured, rinsed, dried, and conditioned. Much of the equipment has been so developed that it is fully automatic and, once started, calls for no further attention by the chemist in charge until the entire cycle is completed.

•TECHNICAL NOTES FROM FOREIGN SOURCES•

Molds: Development, Identification, Prevention

Joseph Rière—R. G. Mat. Col., No. 55, *Dec.,* 1939.—Raulin, a pupil of Pasteur, distinguished by his researches on molds, has studied particularly the nutrition and development of the fungus *Sterigmatocystis nigra.* Based upon his work an examination may be made into the development of molds or mildew on cellulose.

Raulin has given the composition of the culture medium which affords optimum development of *Sterigmatocystis nigra,* a solution of sugar containing also tartaric acid, ammonium nitrate and small quantities of several mineral salts, each component playing its special part in the fungus growth. These observations are of interest as supplying general information on conditions of mold growth which may be utilized in the study to be made.

The ability to assimilate organic substances possessed by fungus varies with the different compounds it may encounter; at the same time it displays a degree of selectivity in regard to foods. In presence of both glycerine and glucose, either of which would supply the carbon it requires, the fungus will utilize first that of the glucose, not attacking the glycerine until the glucose is consumed, a fact which may serve to explain the protective role played by glucose when present in finishing compounds.

If molds are not in contact with such directly assimilable substances as glucose, they are able to secrete a diastase which breaks down the material to be assimilated, an interesting illustration of the ability of fungus to adopt itself to its environment. Its powers in this respect are quite extensive, for it is found to secrete several different kinds of diastase, each appropriate to the particular substance to be dealt with.

Fungus does not feed directly on cellulose, which instead is first broken down by the secreted enzymes to a point permitting assimilation by the micro-organisms. There is first the formation of glucose, then fermentation of the glucose by action of zymase. The degrading of cellulose into glucose is hydrolytic, the enzymes acting as catalyzers, a reaction comparable to the hydrolysis of cellulose by acids. This process of hydrolysis is a progressive depolymerization. Highly polymerized cellulose is attacked by only two species of fungus, *Mucor* and *Aspergillus,* the degree of polymerization playing an important part in its resistance to molds. The degradation proceeds through the successive stage of hydrocellulose, cellodextrine and cellobiose, at which point there is conversion by enzyme action into glucose.

The general conditions necessary to the development of molds include humidity, absence of bright light, presence of food-furnishing materials, depletion of air supply and favorable pH, though these may vary somewhat to suit certain species. The temperature range lies between 20° C. and 40° C. *Aspergillus noire* grows very slowly at 7° C., rapidly at 37° C., and not at all above 43° C.; *Aspergillus blanche* does not develop above 37° C., its most favorable point being 25° C., while *Penicillium* (green) has its maximum growth at 27° C., its development being arrested above 39° C.

Moisture and food supply are also important factors. Some molds grow rapidly with the increase of moisture content of fabrics, while the presence of starch or albumen sizing or finishing materials assures a favorable terrain, as does also presence of hygroscopic compounds. Rayon, which is depolymerized cellulose, is especially open to attack of micro-organisms, and may be completely converted to glucose by the same action that converts cotton to only the extent of about 30 per cent.

Mold or mildew areas on fabrics may present a variety of colors, black, gray, green, yellow, orange or brown. The most common are the "black mildew," very rapid in growth, and the "brown mildew," resembling a patch of rust. They are generally found in the center of the piece, at a distance from the selvages. Mildew growth liberates heat, sometimes up to 70° C., a fact which may aid in its detection. To facilitate microscopic examination, a preliminary treatment of the fibers is desirable. Such a treatment, given by E. Meissner in the Deutsch Woolen Gewebe, consists in first boiling the fabric in water to remove any foreign material, treating for a minute or two in a hot solution of water, phenol, lactic acid and glycerine,

and then immersing for several minutes in a solution of direct blue dye. After rinsing and heating again in the lactophenol solution to remove excess of dye, the parts affected by mildew action remain colored, and the fibers are ready for examination. Affected areas which may be invisible before dyeing are likely to leave white resists when the fabric is dyed with substantive colors.

Mildew may occur on fabrics at different stages of manufacture, whenever favorable conditions prevail, such as in storing sized or finished goods or when wet fabrics are left too long in the pile. Certain precautions may be observed against it, such as storing in dry and ventilated places and avoiding use of hygroscopic materials. A large number of antiseptics may also be utilized to prevent infection, of which some of the most effective are salicylic acid, beta-naphtol and aristol. Also recommended are the sodium salt of parachlorometacresol, hexylresorcinol and emulsions of zinc or aluminum naphtenate. The action of some antiseptics, however, is not always effective against particular species of fungus. *Fusarium*, for example, has been known to develop on a starch mixing containing 10 per cent of zinc chloride. One or two species of *Aspergillus* feed on salicylic acid. It is always dangerous to store finished goods in a warm and moist atmosphere.

If the fungus growth has been detected in a stage which has not actually attacked the cellulose, its effects may be removed by boiling the goods. If this is not successful, a light chloring or treatment with 2 per cent ammonia water may be tried. If the cellulose has been only slightly attacked, the visible effects may be removed by the same treatments somewhat more vigorously applied. Weakening of the fiber, and modification of its dye affinity, however, will persist. The final stage of mildew action results in total destruction of the cellulose.

The Petroleum Industry in France

R. G. Mat. Col., No. 515, *Dec.*, 1939.—Under the "Varia" heading is printed a concise review of the French refining industry, from a lecture delivered by M. Jacques André before the Society of Civil Engineers. In view of the present importance of the industry to a belligerent nation, an article of this kind, though very brief, is not without its interest.

The history of French refining is closely connected with that of the protective tariff which the Government has at various times afforded the industry, later on to withdraw it. A certain amount of protection is actually necessary to compensate for the difference in cost of production between French and foreign refineries. The first law imposing an import duty on finished products, to protect the refining of crudes, was passed in 1864. However, financial difficulties resulting from the war of 1870 turned attention to the revenue-producing possibilities of petroleum. This became a fixed habit, and today, in a budget of 55 milliards, 7 to 8 milliards come from this essential product.

In 1893 was passed a law which revised that of 1864 and reduced import duties on finished petroleum products. Finally the law of 1903 instituted a new tax on refining which proved the death blow to the industry.

When war broke out in 1914 there was no longer a single refinery in France. This fact caused reflection, and when hostilities ended it was decided to attempt the revival of the industry. The laws of 1928, which restored protection, were so encouraging to it that within three years there sprang up not less than fifteen refineries with an annual capacity of six and a half million tons. The Ecole Du Petrole was established at Strasbourg, an institution whose graduates have not disappointed the hopes reposed in them.

Unfortunately, refining costs are higher in France than in the oil producing countries, a fact which excludes the possibility of profitable exportation. It was therefore necessary for French engineers to adjust the production of finished products to an exact agreement with the requirements of the domestic market.

Not satisfied with confining their operations to the long-established method of simple fractional distillation, these young men have made good use of the discovery of "cracking." Further progress was attained in the solvent methods of treatment, which marked another step in the development of refining technique. Though confronted with a host of difficulties, this chemical technique of refining has developed perhaps more rapidly in France than anywhere else. The industry is now at a point which has rendered unnecessary importation of petroleum derivatives, while it supplies to consumers products which compare favorably in quality with those of other countries.

• CLASSIFIED • ADVERTISEMENTS

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED: As laboratory assistant with dyestuff or chemical concern having possibility for advancement into sales field. Age 26, single, B.S. degree in Textile Chemistry. Three and a half years' experience in general plant laboratory work in bleaching, printing, dyeing and finishing cotton piece goods. Write Box No. 235, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Yarn dyer with over ten years' experience on silk, cotton, rayon and fancy yarns. Fast colors a specialty. Also a number of years of yarn printing experience. Able to take care of his own laboratory work. Write Box No. 241, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

TEXTILE COLORIST WANTED: Young man to work in application laboratory of small dyestuff plant in New Jersey. Experienced in matching and application of direct, acetate and developed colors. In letter of application state age, experience, education, marital status and initial salary desired. Write Box No. 242, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.